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EDITORIAL.

Derris

Writing editorially on this subject in August 1936 we pointed out that if derris is to be more widely used as an insecticide it is desirable that growers should be in a position to state the toxic content (rotenone and/or ether extract) of their root within reasonably narrow limits.

The lack of knowledge in this respect and the frequently occurring wide variability in the toxic content of derris from the same source of supply have been without a doubt two factors affecting adversely its use as an insecticide.

There is no need to stress the importance of exporting a standard product, while we would go further and say that if this standard product is of high quality the combination is sufficient advertisement for it in the world's markets.

This Department has for several years past been endeavouring to solve the double problem thus presented, and an article in this issue summarizes the early history of the investigational work undertaken and proceeds to a description of the latest findings. The prime necessity appeared and still appears to be that of developing types with a high and uniform toxic content, and the early investigations started with a study of the toxic content of individual plants of those types favoured by manufacturers.

The individual plants were lifted, the stems reserved for the purpose of striking cuttings and the roots analysed. An arbitrary limit of toxic content was adopted. Cuttings from those plants in which the roots had a toxic content lower than the limit were discarded. The superior cuttings were planted in rows, each row being confined to the vegetative progeny of one parent plant.

Ample space was allowed for the development of the individual plants, while two different types of soil were also selected. In this way it was hoped to develop highly toxic clonal plants of the two types chosen for the experiment.

The results were somewhat surprising, more particularly in respect of the unexpectedly wide variations in toxic content both between a parent plant and any member of the vegetative progeny and also between any two members of the vegetative progeny selected at random. It is interesting to note though that the average toxic content of the vegetative progeny is of the same order as that of the parent plant.

No explanation can at present be offered for the wide variations in toxic content referred to above. Further work is outlined which it is hoped will eventually lead to the isolation of a clonal type having the desirable combination of high toxic content with marked root development.

Although in this respect the results may have been somewhat disappointing there are valuable findings in other directions. In the first place the results show that the toxic content of the root is developed at a much earlier age than previously anticipated. For example, figures show that when the plants are only 13 months old the roots may have a toxic content of the same order as when the plants are almost twice this age. Secondly, it is now apparent that the yield of root per plant is influenced considerably by the spacing, since increase in yield resulted when the plants were spaced more widely apart than the conventional system of 3 ft. x 3 ft. square. It may well be too that toxic content at a particular age is also influenced by spacing.

The above points are of considerable interest to estates in arranging a planting programme, and further experiments are in hand to ascertain the optimum spacing for producing the maximum yield per acre.

In the meantime, estates need have no fear that if they use proved planting material it will deteriorate; the results show that in spite of the variations the average quality remains of the same order from generation to generation.

PRELIMINARY RESULTS OF ANALYSIS OF CLONAL TYPES OF DERRIS UNDER FIELD CONDITIONS

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Introductory.

An account was published in a previous number of this Journal of selection experiments carried out with different species of Derris growing in the General Nursery at the Central Experiment Station, Serdang(1).

The same procedure was adopted in each case. The stems of the individual plants were removed and reserved for the purpose of striking cuttings, after which the complete root systems were lifted. The "fine" or marketable roots (roots of $\frac{1}{2}$ in. diameter or less) were separated and analysed. Determinations of rotenone and ether extract were made.

Cuttings of those plants of *Derris malaccensis* var. *sarawakensis* and *D. elliptica,* Sarawak creeping, having roots of superior toxic content were planted in rows in two different types of soil to ascertain the extent to which the vegetative progeny resembled the parent plant in respect of rotenone and ether extract.

The above two species of Derris were selected as being the most promising of the various types originally established at Serdang judged by yield of root and economic possibilities at the time of the original selection work.

Roots from *D. malaccensis* var. *sarawakensis,* which are characterized by a high ether extract combined with a low rotenone content, were then favoured by British insecticide manufacturers. *D. elliptica,* Sarawak creeping, root with its higher rotenone content, even though this is associated with a moderate ether extract, was more likely to be favoured in the United States of America, where root is judged primarily on its rotenone content.

Lay-Out of Experiment.

Two types of soil were chosen for the experiment. The first belongs to the Valley Quartzite type and may be described as consisting of a dark clay loam with 50 to 60 per cent. fine fractions; the second belongs to the Raub Series and is a yellow friable soil with a good crumb structure.

Deep cultivation was given in both cases before planting.

The rooted cuttings were set in rows 8 ft. apart with 5 ft. between the plants in the rows.

The individual plants were therefore given much more space for development than the parent plants, 40 sq. ft. per plant compared with about 9 sq. ft. for a parent plant.

Results of Analysis.

The results of analysis for the two species of Derris on the two types of soil will be considered separately under the following headings:—

(a) Yields of root at different ages.
(b) Variations in character of root from individual plants.
(c) Variations in ether extract of root from plants of different ages.
(d) Variations in rotenone content of root from plants of different ages.
(e) Correlation between rotenone content and ether extract.

Derris malaccensis var. *sarawakensis*.

(a) *Yields of Root at Different Ages.*

Marked differences have been found between the weights of air-dry (moisture content 8 per cent.) marketable root from individual members of a vegetative progeny from a single parent plant set in a row. These differences apply equally to both types of soil.

Table I shows the results obtained with two series of plants harvested at the same age as the parent plants. Thus, in the case of the vegetative progeny of plant No. 5 on the Valley Quartzite soil, the weights vary from 26.53 to 8.85 ozs., with an average of 18.99 ozs., while for that of plant No. 29 on the Raub Series soil the weights vary from 19.22 to 5.47 ozs. with an average of 10.44 ozs.

Although there are wide differences between the weights of root from individual plants it is interesting to note that the average figure for both types of soil is of the same order.

Comparing the vegetative progeny with the respective parent plants in which the yields of root were of the same order the figures show that the average weight of root on both types of soil is much greater in the case of the vegetative progeny of plant No. 5 than for plant No. 29. The average weight of root for the progeny of No. 5 is 17.60 ozs. compared with 10.14 ozs. for No. 29. In the case of plant No. 5 this represents a three-fold increase compared with a two-fold increase for No. 29.

While it is reasonable to assume that this increase can be attributed largely to the wider spacing of the plants the results show that it is not proportionate to the increased area allotted per plant. Thus, assuming the parent plants and the vegetative progeny had 9 and 40 sq. ft. respectively for development, the average weights of root for the two progeny should have been of the order of $\frac{40}{9}$ x 5.2, say 23 ozs. In the case of plant No. 5 there is a deficiency of about 5 ozs. and for No. 29 one of over 13 ozs.

Reference to Table II shows, however, that the calculated increase in weight may be largely exceeded, notably in the case of plants Nos. 1 and 2. While in the case of plant No. 2 the increased age at which the vegetative progeny were harvested compared with that for the parent plant may be a contributing factor towards the higher yield of root, the vegetative progeny of plant No. 1 were harvested 7 months earlier than the parent plant.

Table I.

Comparative Yields of Air-Dry Marketable Root from Individual Plants of *Derris malaccensis* var. *sarawakensis*, 24 months old on Different Types of Soil at Serdang.

Parent Plant, No. 5		*5.11 ozs.*
Serial No. of Vegetative Progeny	Nature of Soil	
	Valley Quartzite	Raub Series
	ozs.	ozs.
1 ...	20.63	14.65
2 ...	16.58	26.98
3 ...	20.81	12.56
4 ...	25.22	20.04
5 ...	18.34	13.23
6 ...	26.53	14.08
7 ...	8.85	15.31
8 ...	14.99	12.88
Maximum ...	26.53	26.98
Minimum ...	8.85	12.56
Average ...	18.99	16.22
Parent Plant, No. 29		*5.30 ozs.*
1 ...	34.74	13.19
2 ...	11.89	10.33
3 ...	5.82	8.01
4 ...	9.52	6.95
5 ...	3.88	19.22
6 ...	2.82	5.47
7 ...	3.70	12.84
8 ...	6.35	7.48
Maximum ...	34.74	19.22
Minimum ...	2.82	5.47
Average ...	9.84	10.44

With regard to the effect of age on yield of root, the figures in Table III, which cover all the plants harvested at the different ages, indicate a gradual increase in yield for both types of soil up to an age of 24 months. After this there would appear to be little or no variation in yield of root.

(b) *Variations in Character of Root from Individual Plants.*

The character of the root varies with the individual plant. Thus, the root system of one plant in a row may contain a high proportion of roots varying in size from $\frac{1}{2}$ to $\frac{1}{4}$ in. in diameter, while the next plant in the same row, yielding approximately the same amount of root, may contain a similar high proportion of roots of a smaller size.

The results of two series of determinations are shown in Table IV.

The figures also show that a high proportion of the large-sized roots, $\frac{1}{2}$ to $\frac{1}{4}$ in. diameter, is not necessarily correlated with a marked root development. Thus, in the case of Nos. 4 and 5 of the vegetative progeny from parent plant No. 11 there is a difference of over 13 per cent. in the proportion of the large-sized roots, although the total yield of root in both cases is of the same order.

Table II.

Average Weights of Air-Dry Marketable Root from Individual Plants of *Derris malaccensis* var. *sarawakensis* on Different Types of Soil at Serdang.

Reference No. of Plant	Details of Plants	No. of Plants Harvested	Age of Plants	Nature of Soil		
				General Nursery	Valley Quartzite	Raub Series
			months	ozs.	ozs.	ozs.
1	*Parent plant* ...	*1*	*24*	*1.24*		
	Vegetative progeny ...	8	17		8.65	6.88
2	*Parent plant* ...	*1*	*24*	*1.94*		
	Vegetative progeny ...	6	35		25.74	14.41
5	*Parent plant* ...	*1*	*24*	*5.11*		
	Vegetative progeny ...	8	24		18.99	16.22
7	*Parent plant* ...	*1*	*24*	*2.86*		
	Vegetative progeny ...	4	17		7.25	5.88
8	*Parent plant* ...	*1*	*24*	*8.47*		
	Vegetative progeny ...	4	17		6.62	9.50
9	*Parent plant* ...	*1*	*24*	*3.32*		
	Vegetative progeny ...	2	13		2.20	3.05
	do. do. ...	2	16		3.40	5.50
	do. do. ...	6	35		6.24	11.69
11	*Parent plant* ...	*1*	*24*	*4.52*		
	Vegetative progeny ...	3	13		2.00	3.40
	do. do. ...	4	15		2.90	7.17
22	*Parent plant* ...	*1*	*24*	*6.59*		
	Vegetative progeny ...	3	13		2.60	5.73
	do. do. ...	4	15		4.27	8.65
29	*Parent plant* ...	*1*	*24*	*5.30*		
	Vegetative progeny ...	8	24		9.84	10.44
34	*Parent plant* ...	*1*	*24*	*4.44*		
	Vegetative progeny ...	2	13		1.25	3.40

Table III.

Yields of Air-Dry Marketable Root from Individual Plants of *Derris malaccensis* var. *sarawakensis* of Varying Ages on Different Types of Soil at Serdang.

Age of Plants	No. of Plants	Valley Quartzite			Raub Series		
		Maximum	Minimum	Average	Maximum	Minimum	Average
months		ozs.	ozs.	ozs.	ozs.	ozs.	ozs.
13	10	3.70	0.70	2.07	8.30	1.20	4.03
15	8	7.40	0.90	3.16	12.80	4.80	7.91
17	16	12.80	2.40	7.80	13.10	3.40	7.28
24	16	34.74	2.82	14.42	26.98	5.47	13.33
35	12	29.80	1.16	15.99	24.90	1.13	13.05

Table IV.

Proportions by Weight of Roots of Varying Sizes from Individual Plants of *Derris malaccensis* var. *sarawakensis* 15 months old on Raub Series Soil at Serdang.

Parent Plant No.	Serial No. of Vegetative Progeny	Weight of Air-dry Marketable Roots	Proportion of Roots		
			½ to ¼ in. diameter	¼ to ⅛ in. diameter	⅛ in. diameter and less
		ozs.	per cent.	per cent.	per cent
11	4	9.00	21.7	46.4	31.9
	5	8.00	8.2	59.1	32.7
	6	6.20	17.2	47.9	34.9
Average		7.73	15.7	51.1	33.2
22	4	11.60	25.2	48.7	26.1
	5	12.80	29.0	38.5	32.5
	6	4.80	22.2	46.8	31.0
	7	5.70	24.8	43.3	31.9
Average		8.70	25.3	44.3	30.4

Table V.

Variations in Ether Extract of Marketable Root from Individual Plants of *Derris malaccensis* var. *sarawakensis* on Different Types of Soil at Serdang.

(Moisture-free basis)

Serial No. of Vegetative Progeny	Age of Plants	Nature of Soil	
		Valley Quartzite	Raub Series
	months	per cent.	per cent.
(a) Parent Plant, No. 11, 24 months old, 22.57 per cent.			
1	13	25.30	27.45
2		26.03	23.96
3		24.53	28.17
Average		25.29	26.53
4	15	25.48	25.48
5		26.91	26.41
6		25.15	25.30
7		26.28	28.12
Average		25.96	26.33
(b) Parent Plant, No. 1, 24 months old, 20.88 per cent.			
1	17	22.30	25.26
2		27.56	25.21
3		27.06	27.44
4		28.78	27.66
5		25.93	27.38
6		19.91	22.55
7		20.77	24.25
8		20.83	23.14
Maximum		28.78	27.66
Minimum		19.91	22.55
Average		24.14	25.36
(c) Parent Plant, No. 29, 24 months old, 23.09 per cent.			
1	24	32.76	32.89
2		25.54	25.79
3		28.19	26.37
4		23.93	28.25
5		23.80	23.60
6		25.07	23.61
7		21.95	30.23
8		26.87	26.27
Maximum		32.76	32.89
Minimum		21.95	23.60
Average		26.01	27.13
(d) Parent Plant, No. 9, 24 months old, 25.65 per cent.			
5	35	23.93	22.43
6		20.94	21.35
7		23.34	18.08
8		22.61	19.08
9		21.40	17.38
10		22.69	19.70
Average		22.48	19.67

Table VI.

Average Ether Extract of Marketable Root from Individual Plants of *Derris malaccensis* var. *sarawakensis* on Different Types of Soil at Serdang.

(Moisture-free basis)

Reference No. of Plant	Details of Plants	No. of Plants Harvested	Age of Plants	Nature of Soil		
				General Nursery	Valley Quartzite	Raub Series
			months	per cent.	per cent.	per cent.
1	*Parent plant* ...	*1*	*24*	*20.88*		
	Vegetative progeny ...	8	17		24.14	25.36
2	*Parent plant* ...	*1*	*24*	*21.24*		
	Vegetative progeny ...	6	35		16.67	20.27
5	*Parent plant* ...	*1*	*24*	*21.07*		
	Vegetative progeny ...	8	24		21.90	25.36
7	*Parent plant* ..	*1*	*24*	*22.16*		
	Vegetative progeny ..	4	17		24.73	23.17
8	*Parent plant* ..	*1*	*24*	*22.00*		
	Vegetative progeny ..	4	17		23.14	25.79
9	*Parent plant* ...	*1*	*24*	*25.65*		
	Vegetative progeny ...	2	13		31.07	27.08
	do. do. ...	2	16		29.13	28.37
	do. do. ...	6	35		22.48	19.67
11	*Parent plant* ...	*1*	*24*	*22.57*		
	Vegetative progeny ...	3	13		25.29	26.53
	do. do. ...	4	15		25.96	26.33
22	*Parent plant* ...	*1*	*24*	*21.40*		
	Vegetative progeny ...	3	13		25.99	28.17
	do. do. ...	4	15		22.93	25.82
29	*Parent plant* ...	*1*	*24*	*23.09*		
	Vegetative progeny ...	8	24		26.01	27.13
34	*Parent plant* ...	*1*	*24*	*23.00*		
	Vegetative progeny ...	2	13		27.53	29.33

(c) *Variations in Ether Extract of Root from Plants of Different Ages.*

The results indicate that, while ether extract has developed in the root at a comparatively early age, there may be a wide difference between the figure for a parent plant and that of any member of its vegetative progeny, also between any two members of the progeny selected at random.

Table V illustrates the range of this variation found with plants of different ages. Thus, in the case of the vegetative progeny of plant No. 29 aged 24 months on the Valley Quartzite soil, there is a difference of nearly 10 per cent. between the ether extract for the parent plant and progeny No. 1. There is also a difference of nearly 11 per cent. between the maximum and minimum figures for the vegetative progeny, plants Nos. 1 and 7 respectively.

Reference to Table VI shows that, with the exception of the plants aged 35 months, the average figure for any vegetative progeny is slightly higher than that for the corresponding parent plant. It is possible that the lower range of figures for the 35 months old plants can be correlated with a decrease in ether extract with increase in age. Attention has already been drawn to this decrease in another paper published recently in this Journal(2).

The possibility of a difference in ether extract between any two individual plants being due to a combined effect of the variations in the proportions of different sized roots and in their ether extract has also been considered. Previous work has shown a difference in ether extract according to the size of root(3).

Table VII shows the results obtained with one series of individual plants.

The figures confirm those obtained previously as regards the variations in this respect. The ether extract tends to decrease with decreasing size of root.

Table VII.

Variations in Ether Extract of Roots of Different Sizes from Individual Plants of *Derris malaccensis* var. *sarawakensis* aged 15 months on Raub Series Soil at Serdang.

(Moisture-free basis)

Parent Plant No.	Serial No. of Vegetative Progeny	Ether Extract		
		Roots $\frac{1}{2}$ to $\frac{1}{4}$ in. diameter	Roots $\frac{1}{4}$ to $\frac{1}{8}$ in. diameter	Roots $\frac{1}{8}$ in. diameter and less
		per cent.	per cent.	per cent.
22	4	28.18	25.84	24.43
	5	26.36	25.41	22.81
	6	28.55	29.33	23.95
	7	25.60	25.88	22.96
Average		27.17	26.61	23.54

To illustrate the extent of the possible variation between the figures for ether extract of the roots of two individual plants due to differences in character of root the following example has been worked out. The figures are calculated on a moisture-free basis.

Parent plant	No. 22	
Serial No. of vegetative progeny ...	No. 4	No. 5
	ozs.	ozs.
Weight of roots	10.65	11.82
Proportion of roots:	per cent.	per cent.
Diameter ½ to ¼ in.	25.2	29.0
-do- ¼ to ⅛ in.	48.7	38.5
-do- ⅛ in. and less	26.1	32.5
	100.0	100.0
Ether extract of roots:		
Diameter ½ to ¼ in.	28.18	26.36
-do- ¼ to ⅛ in.	25.84	25.41
-do- ⅛ in. and less	24.43	22.81
Average ether extract	26.06	24.84

By combining the proportions of the different sized roots of vegetative progeny No. 4 with the figures for ether extract of the corresponding sizes for vegetative progeny No. 5 and *vice versa* the following figures for average ether extract are obtained, those determined by analysis being added for purposes of comparison.

	Ether Extract	
	Calculated as Indicated per cent.	Determined by Analysis per cent.
Vegetative progeny No. 4	26.06	26.06
-do- -do- No. 5	24.86	24.84

The close agreement in both cases tends to show that the combined effect of a variation in the proportions of different sized root and in the ether extract for each size of root is too small to account for the wide difference which may be found between the figures for ether extract for roots from two plants of the same progeny selected at random. This difference must therefore be due to other unknown factors.

(d) *Variations in Rotenone Content of Root from Plants of Different Ages.*

Unlike ether extract, it is not possible to make a comparison of the rotenone content of a parent plant and its vegetative progeny owing to the unreliability of the method used for the determination of rotenone when the parent plants were being analysed. The details of that method have already been published in this Journal(3).

The first stage in that method was the extraction of the powdered root in a Soxhlet extractor with boiling carbon tetrachloride for a period of 16 hours. Investigations by Seaber (4) showed that rotenone was liable to decompose slightly during prolonged boiling with carbon tetrachloride. This was confirmed by experiments carried out in this laboratory by Dr. T. A. Buckley, Chemist, who also showed that even after prolonged boiling the rotenone might not be completely extracted.

The hot carbon tetrachloride method was discontinued and the extraction of the powdered root with chloroform at room temperature substituted. As far as can be ascertained this method of extraction was proposed originally by Danckwortt and Budde, and modified by Beach. Later, further modifications in Beach's method were introduced by Jones and Graham (5 & 6).

Although this method is open to a few minor objections, it has been tested thoroughly and found to give consistent results.

A description of the method as used in this laboratory is given in Appendix "A."

In this connexion it may be mentioned that the question of the adoption of a standard method for rotenone estimation is engaging the attention of the Imperial Institute Consultative Committee on Insecticidal Materials of Vegetable Origin. Workers both in Great Britain and other countries, notably, the United States of America, Holland and Netherlands Indies are collaborating.

As far as the present paper is concerned, only those results obtained by extraction with chloroform at room temperature will be considered. Reliable figures are available only from 24 months onwards.

As is the case with ether extract, the results indicate the possibility of a wide difference in rotenone content between any two members of a vegetative progeny selected at random.

Table VIII illustrates the range of variation found with plants aged 24 and 35 months respectively. Thus, in the case of the vegetative progeny of plant No. 5 aged 24 months on the Valley Quartzite soil there is a difference of more than 3 per cent. between the maximum and minimum figures for rotenone, plants Nos. 3 and 8 respectively.

Further, there may be wide variations between the average figures for rotenone for the same number of individual members of one vegetative progeny grown on different types of soil. This is illustrated in the case of the vegetative progeny of plant No. 29 at 24 months old and of plant No. 9 at 35 months old. In both cases there are differences of about 1.5 per cent., the figures for the Raub Series soil being consistently lower.

Table VIII.

Rotenone Content of Marketable Root from Individual Plants of *Derris malaccensis* var. *sarawakensis* at Varying Ages on Different Types of Soil at Serdang.

(Moisture-free basis)

Parent Plant No.	Serial No. of Vegetative Progeny	Age of Plants	Nature of Soil	
			Valley Quartzite	Raub Series
		months	per cent.	per cent.
5	1	24	3.17	2.29
	2		2.64	2.36
	3		4.72	2.80
	4		3.21	2.35
	5		2.39	2.76
	6		2.94	3.69
	7		2.10	3.29
	8		1.44	3.13
	Maximum		4.72	3.69
	Minimum		1.44	2.29
	Average		2.83	2.84
29	1	24	4.58	3.76
	2		4.91	3.88
	3		6.17	3.48
	4		4.42	3.67
	5		5.20	3.59
	6		4.99	3.88
	7		4.99	3.54
	8		5.88	3.11
	Maximum		6.17	3.88
	Minimum		4.42	3.11
	Average		5.14	3.61
2	1	35	3.34	3.52
	2		3.30	3.29
	3		2.80	3.50
	4		2.97	3.50
	5		3.31	3.09
	6		2.84	3.24
	Maximum		3.34	3.52
	Minimum		2.80	3.09
	Average		3.09	3.36
9	5	35	3.97	3.35
	6		3.55	2.83
	7		5.06	2.88
	8		5.68	3.12
	9		4.72	3.26
	10		4.69	2.94
	Maximum		5.68	3.35
	Minimum		3.55	2.83
	Average		4.61	3.06

Table IX.

Relationship between Rotenone and Ether Extract for Marketable Root of *Derris malaccensis* var. *sarawakensis* on Different Types of Soil at Serdang.

(The figures for rotenone and ether extract are calculated on a moisture-free basis).

Parent Plant No.	Serial No. of Vegetative Progeny	Age of Plants	Nature of Soil					
			Valley Quartzite			Raub Series		
			Rotenone	Ether Extract	Proportion of Rotenone to Ether Extract	Rotenone	Ether Extract	Proportion of Rotenone to Ether Extract
		months	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.
5	1	24	3.17	20.30	15.6	2.29	26.77	8.6
	2		2.64	20.58	12.8	2.36	23.60	10.0
	3		4.72	33.26	14.2	2.80	26.32	10.6
	4		3.21	27.13	11.8	2.35	23.32	10.1
	5		2.39	18.31	13.1	2.76	24.07	11.5
	6		2.94	27.09	10.9	3.69	25.06	14.7
	7		2.10	15.42	13.7	3.29	29.70	11.1
	8		1.44	13.13	11.0	3.13	24.06	13.0
	Maximum		4.72	33.26	15.6	3.69	29.70	14.7
	Minimum		1.44	13.13	10.9	2.29	23.32	8.6
	Average		2.83	21.90	12.9	2.84	25.36	11.2
9	5	35	3.97	23.93	16.6	3.35	22.43	14.9
	6		3.55	20.94	16.9	2.83	21.35	13.2
	7		5.06	23.34	21.7	2.88	18.08	15.9
	8		5.68	22.61	25.1	3.12	19.08	16.4
	9		4.72	21.40	22.1	3.26	17.38	18.7
	10		4.69	22.69	20.7	2.94	19.70	14.9
	Maximum		5.68	23.93	25.1	3.35	22.43	18.7
	Minimum		3.55	20.94	16.6	2.83	17.38	13.2
	Average		4.61	22.48	20.5	3.06	19.67	15.3

(e) *Correlation between Rotenone Content and Ether Extract.*

The results of analysis indicate a wide range of variation between the proportion which the amount of rotenone bears to the ether extract.

Table IX illustrates the extent of the differences found with individual members of two vegetative progeny growing on the two types of soil. Thus, in the case of the vegetative progeny of plant No. 5 aged 24 months, the figures vary from 15.6 to 10.9 per cent. for the Valley Quartzite soil and from 14.7 to 8.6 per cent. for the Raub Series soil. The average figure in both cases is, however, of the same order, 12.9 compared with 11.2 per cent.

In the case of the vegetative progeny of plant No. 9 aged 35 months, there is a still wider range of variation for the Valley Quartzite soil, the figures varying from 25.1 to 16.6 per cent. In this case also there is a marked difference between the average figures for the two types of soil, 20.5 per cent. for the Valley Quartzite soil compared with 15.3 per cent. for the Raub Series.

It is interesting to note that the average figures for the proportion of the rotenone to ether extract at 35 months are slightly higher than those at 24 months. This increase is noticeable in the case of both types of soil as the figures in Table X show.

Table X.

Proportion of Rotenone to Ether Extract for Marketable Root of *Derris malaccensis* var. *sarawakensis* on Different Types of Soil at Serdang.

Age of Plants	No. of Plants	Nature of Soil					
		Valley Quartzite			Raub Series		
		Maximum	Minimum	Average	Maximum	Minimum	Average
months.		per cent.	per cent.	per cent.	per cent.	per cent.	per cent.
24	16	22.7	10.9	16.4	16.4	8.6	12.3
35	12	25.1	15.6	19.5	19.1	13.2	15.3

***Derris elliptica*, Sarawak creeping.**

(a) *Yields of Root at Different Ages.*

Similarly to *D. malaccensis* var. *sarawakensis*, marked differences were found between the weights of the air-dry marketable root from the individual members of a vegetative progeny from a single parent plant.

Table XI shows the results obtained with two series of plants harvested at the same age as the parent plants. Thus, in the case of the vegetative progeny of plant No. 7 on the Valley Quartzite soil the weights vary from 13.93 to 6.07 ozs. with an average of 10.48 ozs., while for that of plant No. 17 on the Raub Series soil the weights vary from 38.16 to 9.77 ozs. with an average of 23.60 ozs.

It is interesting to note that, while the average figure for both types of soil is of the same order for plant No. 17, in the case of plant No. 5 the average weight of root per plant on the Raub Series soil is nearly three times as great as on the Valley Quartzite soil.

Comparing the vegetative progeny with the respective parent plants the figures show that the average weight of root on both types of soil is slightly greater in the case of the vegetative progeny for plant No. 17 than for plant No. 7. The average weight of root for the progeny of No. 17 is 23.53 ozs. compared with 19.10 ozs. for No. 7. In the case of plant No. 17 this represents a two-fold increase but for No. 7 the increase is approximately ten-fold.

Reference to Table XII, in which the average weights of root at different ages are compared, will show that such an increase is not abnormal.

The results would appear to indicate that under suitable conditions a marked root development is a feature of this species. Attention has been drawn previously ot the high yield of root obtained in manurial trials with this species(7).

Table XI.

Comparative Yields of Air-Dry Marketable Root from Individual Plants of *Derris elliptica*, Sarawak creeping, 24 months old on Different Types of Soil at Serdang.

Parent Plant, No. 7		*2.36 ozs.*
Serial No. of Vegetative Progeny	Nature of Soil	
	Valley Quartzite	Raub Series
	ozs.	ozs.
3 ...	12.38	27.76
4 ...	9.21	35.41
5 ...	13.93	20.63
6 ...	13.83	29.59
7 ...	6.07	25.61
8 ...	12.10	28.47
9 ...	8.25	28.78
10 ...	8.04	25.50
Maximum ...	13.93	35.41
Minimum ...	6.07	20.63
Average ...	10.48	27.72
Parent Plant, No. 17		*9.77 ozs.*
3 ...	25.50	38.16
4 ...	31.46	36.36
5 ...	33.44	14.67
6 ...	16.44	36.15
7 ...	16.22	22.89
8 ...	12.88	17.74
9 ...	24.58	13.05
10 ...	27.12	9.77
Maximum ...	33.44	38.16
Minimum ...	12.88	9.77
Average ...	23.46	23.60

Table XII.

Average Weights of Air-Dry Marketable Root from Individual Plants of *Derris elliptica*, Sarawak creeping, on Different Types of Soil at Serdang.

Reference No. of Plant	Details of Plants	No. of Plants Harvested	Age of Plants	Nature of Soil		
				General Nursery	Valley Quartzite	Raub Series
			months	ozs.	ozs.	ozs.
2	*Parent plant* ...	*1*	*24*	*2.33*		
	Vegetative progeny ...	8	17		15.89	16.49
3	*Parent plant* ...	*1*	*24*	*5.50*		
	Vegetative progeny ...	3	13		8.67	5.50
	do. do. ...	4	15		11.75	8.75
5	*Parent plant* ...	*1*	*24*	*1.09*		
	Vegetative progeny ...	4	17		16.18	11.35
7	*Parent plant* ...	*1*	*24*	*2.36*		
	Vegetative progeny ...	2	16		6.70	21.95
	do. do. ...	8	24		10.48	27.72
8	*Parent plant* ...	*1*	*24*	*2.86*		
	Vegetative progeny ...	2	16		11.50	15.35
9	*Parent plant* ...	*1*	*24*	*3.20*		
	Vegetative progeny ...	2	13		11.65	11.80
	do. do. ...	2	16		12.50	14.25
	do. do. ...	6	34		23.14	30.43
10	*Parent plant* ...	*1*	*24*	*2.12*		
	Vegetative progeny ...	2	16		11.60	14.75
11	*Parent plant* ...	*1*	*24*	*4.23*		
	Vegetative progeny ...	2	16		14.85	17.20
12	*Parent plant* ...	*1*	*24*	*4.69*		
	Vegetative progeny ...	2	16		16.10	12.60
13	*Parent plant* ...	*1*	*24*	*4.83*		
	Vegetative progeny ...	4	17		25.20	16.45
16	*Parent plant* ...	*1*	*24*	*9.00*		
	Vegetative progeny ...	3	13		6.87	6.50
	do. do. ...	4	15		12.50	18.27
17	*Parent plant* ...	*1*	*24*	*9.77*		
	Vegetative progeny ...	8	24		23.46	23.60
31	*Parent plant* ...	*1*	*24*	*4.06*		
	Vegetative progeny ...	6	34		24.01	25.54

As is the case with *D. malaccensis* var. *sarawakensis* there would appear to be on both types of soil a gradual increase in yield of root with increase in age of plant. In the case of the Valley Quartzite soil the figures show the increase to be continuous up to 35 months, the limit of the experiment, but with the Raub Series soil the yields at 24 and 35 months are of the same order. Table XIII gives the details for each age of harvesting.

Table XIII.

Yields of Air-Dry Marketable Root from Individual Plants of *Derris elliptica*, Sarawak creeping, of Varying Ages on Different Types of Soil at Serdang.

Age of Plants	No. of Plants	Valley Quartzite			Raub Series		
		Maximum	Minimum	Average	Maximum	Minimum	Average
months		ozs.	ozs.	ozs.	ozs.	ozs.	ozs.
13	10	15.50	4.20	8.56	16.20	3.90	7.14
15	8	15.20	7.70	12.11	22.20	6.90	13.51
16	16	17.60	5.80	12.44	33.30	5.30	14.72
17	16	28.60	6.10	18.29	28.30	8.00	15.13
24	16	33.44	6.47	16.96	38.16	9.77	25.66
34	12	34.10	16.38	23.58	36.31	13.76	27.99

(b) *Variations in Character of Root from Individual Plants.*

The variations in character of root from individual plants were found to be much more marked with this species than with *D. malaccensis* var. *sarawakensis*.

The results of two series of determinations are shown in Table XIV.

The figures confirm the results obtained with *D. malaccensis* var. *sarawakensis* regarding the absence of any correlation between size of roots and root development. Thus, in the case of Nos. 4 and 7 of the vegetative progeny from parent plant No. 16 there is a difference of over 20 per cent. in the proportion of the large-sized roots, $\frac{1}{2}$ to $\frac{1}{4}$ in., although the total yield of root in both cases is of the same order amounting to more than 1 lb. Such a yield of root may be considered well above the average.

(c) *Variations in Ether Extract of Root from Plants of Different Ages.*

The results indicate again the possibility of considerable differences at all ages between the figures for a parent plant and that of any member of its vegetative progeny, also between any two members of the progeny selected at random.

Table XIV.

Proportions by Weight of Roots of Varying Sizes from Individual Plants of *Derris elliptica*, Sarawak creeping, 15 months old on Raub Series Soil at Serdang.

Parent Plant No.	Serial No. of Vegetative Progeny	Weight of Air-dry Marketable Root	Proportion of Roots		
			¼ to ½ in. diameter	⅛ to ¼ in. diameter	⅛ in. diameter and less
		ozs.	per cent.	per cent.	per cent
3	4	9.85	41.2	35.8	23.0
	5	6.86	30.2	36.8	33.0
	6	10.81	23.4	44.0	32.6
	7	7.44	36.6	40.2	23.2
Average		8.74	32.8	39.3	27.9
16	4	17.40	43.6	38.8	17.6
	5	15.80	25.7	46.2	28.1
	6	22.20	34.4	37.0	28.6
	7	17.70	22.5	51.3	26.2
Average		18.28	31.6	43.3	25.1

Table XV illustrates the range of variation found with plants of different ages. Thus, for the vegetative progeny of plant No. 7 at 24 months on Valley Quartzite soil there is a difference of more than 10 per cent. between the ether extract for the parent plant and vegetative progeny No. 10. There is also at the same age a difference of nearly 6 per cent. between the maximum and minimum figures of the vegetative progeny, plants Nos. 5 and 10 respectively.

Reference to Table XVI shows that, with very few exceptions, the average figure for any vegetative progeny is less than that for the corresponding parent plant.

Further, the lower average figure for Raub Series soil compared with Valley Quartzite soil is also of interest.

Table XV.

Variations in Ether Extract of Marketable Root from Individual Plants of *Derris elliptica*, Sarawak Creeping, at Varying Ages on Different Types of Soil at Serdang.

(Moisture-free basis)

Serial No. of Vegetative Progeny	Age of Plants	Nature of Soil	
		Valley Quartzite	Raub Series
	months	per cent.	per cent.
(a) Parent Plant, No. 16, 24 months old, 25.90 per cent.			
1 ...	13	26.36	26.10
2 ...		23.30	27.25
3 ...		20.78	26.06
Average		23.48	26.47
4 ...	15	26.07	21.45
5 ...		22.72	24.67
6 ...		23.15	22.03
7 ...		20.82	23.71
Average		23.19	22.97
(b) Parent Plant, No. 2, 24 months old, 25.36 per cent.			
1 ...	17	24.05	18.69
2 ...		29.22	20.05
3 ...		26.98	22.36
4 ...		24.67	23.36
5 ...		22.24	20.52
6 ...		24.50	24.74
7 ...		21.42	22.18
8 ...		19.74	22.87
Average		24.10	21.85
(c) Parent Plant, No. 7, 24 months old, 29.13 per cent.			
1 ...	16	26.61	22.55
2 ...		28.50	24.32
Average		27.56	23.44
3 ...	24	23.39	19.11
4 ...		20.80	18.43
5 ...		24.61	16.46
6 ...		19.83	19.77
7 ...		22.65	19.86
8 ...		19.82	20.83
9 ...		24.27	18.04
10 ...		18.92	20.85
Average		21.79	19.17
(d) Parent Plant, No. 9, 24 months old, 29.65 per cent.			
1 ...	13	24.24	24.96
2 ...		23.33	24.44
Average		23.79	24.70
3 ...	16	25.14	23.15
4 ...		24.75	19.38
Average		24.95	21.27
5 ...	34	27.41	22.01
6 ...		27.37	14.27
7 ...		27.55	17.23
8 ...		24.67	18.49
9 ...		24.24	19.52
10 ...		24.23	18.75
Average		25.91	18.38

Table XVI.

Average Ether Extract of Marketable Root from Individual Plants of *Derris elliptica*, Sarawak creeping, on Different Types of Soil at Serdang.

(Moisture-free basis)

Reference No. of Plant	Details of Plants	No. of Plants Harvested	Age of Plants	Nature of Soil		
				General Nursery	Valley Quartzite	Raub Series
			months	per cent.	per cent.	per cent.
2	*Parent plant* ...	*1*	*24*	*25.36*		
	Vegetative progeny ...	8	17		24.10	21.85
3	*Parent plant* ...	*1*	*24*	*27.47*		
	Vegetative progeny ..	3	13		25.82	23.42
	do. do. ...	4	15		21.10	24.54
5	*Parent plant* ...	*1*	*24*	*26.24*		
	Vegetative progeny ...	4	17		24.33	21.26
7	*Parent plant* ...	*1*	*24*	*29.13*		
	Vegetative progeny ...	2	16		27.56	23.44
	do. do. ...	8	24		21.79	19.17
8	*Parent plant* ...	*1*	*24*	*29.12*		
	Vegetative progeny ...	2	16		26.25	21.02
9	*Parent plant* ...	*1*	*24*	*29.65*		
	Vegetative progeny ...	2	13		23.79	24.70
	do. do. ...	2	16		24.95	21.27
	do. do. ...	6	34		25.91	18.75
10	*Parent plant* ...	*1*	*24*	*27.67*		
	Vegetative progeny ...	2	16		24.96	23.00
11	*Parent plant* ...	*1*	*24*	*28.47*		
	Vegetative progeny ...	2	16		22.53	21.62
12	*Parent plant* ...	*1*	*24*	*29.43*		
	Vegetative progeny ...	2	16		23.19	18.13
13	*Parent plant* ...	*1*	*24*	*26.59*		
	Vegetative progeny ...	4	17		24.78	19.29
16	*Parent plant* ...	*1*	*24*	*25.90*		
	Vegetative progeny ...	3	13		23.48	26.47
	do. do. ...	4	15		23.19	22.97
17	*Parent plant* ...	*1*	*24*	*24.99*		
	Vegetative progeny ...	8	24		25.88	21.12
31	*Parent plant* ...	*1*	*24*	*25.94*		
	Vegetative progeny ...	6	34		25.75	23.54

The possibility of a difference in ether extract between any two individual plants being due to a combined effect of the variation in the proportions of different sized roots and their ether extract was similarly considered. Previous work has shown a difference in ether extract according to the size of root (3).

Table XVII shows the results obtained with one series of individual plants.

The figures confirm those obtained previously as regards the variations in this respect. The roots with a diameter of $\frac{1}{4}$ to $\frac{1}{8}$ in. have the highest ether extract, followed by those with a diameter of $\frac{1}{2}$ to $\frac{1}{4}$ in. The very fine roots with a diameter of $\frac{1}{8}$ in. and less have the lowest ether extract.

Table XVII.

Variations in Ether Extract of Roots of Different Sizes from Individual Plants of *Derris elliptica*, Sarawak creeping, aged 15 months on Raub Series Soil at Serdang.

(Moisture-free basis)

Parent Plant No.	Serial No. of Vegetative Progeny	Ether Extract		
		Roots $\frac{1}{2}$ to $\frac{1}{4}$ in. diameter	Roots $\frac{1}{4}$ to $\frac{1}{8}$ in. diameter	Roots $\frac{1}{8}$ in. diameter and less
		per cent.	per cent.	per cent.
3	4	26.56	26.88	22.25
	5	22.30	26.34	22.73
	6	22.40	24.63	21.71
	7	25.25	27.65	21.64
	Average	24.13	26.38	22.08

To illustrate the extent of the possible variation between the figures for ether extract of the roots of two individual plants due to differences in character of root a similar example to that taken in the case of *D. malaccensis* var. *sarawakensis* will be worked out. The figures are calculated on a moisture-free basis.

Parent plant	No. 3	
Serial No. of vegetative progeny ...	No. 4	No. 6
	ozs.	ozs.
Weight of roots	9.07	9.95
Proportion of roots:	per cent.	per cent.
Diameter $\frac{1}{2}$ to $\frac{1}{4}$ in.	41.2	23.4
-do- $\frac{1}{4}$ to $\frac{1}{8}$ in.	35.8	44.0
-do- $\frac{1}{8}$ in. and less	23.0	32.6
	100.0	100.0

Ether extract of roots:		
Diameter $\frac{1}{2}$ to $\frac{1}{4}$ in.	26.56	22.40
-do- $\frac{1}{4}$ to $\frac{1}{8}$ in.	26.88	24.63
-do- $\frac{1}{8}$ in. and less ...	22.25	21.71
Average ether extract	25.68	23.15

Combining the proportions of the different sized roots of vegetative progeny No. 4 with the figures for ether extract of the corresponding sizes for vegetative progeny No. 6 and *vice versa*, the following figures for average ether extract are obtained, those determined by analysis being added for purposes of comparison.

	Ether Extract	
	Calculated as Indicated per cent.	Determined by Analysis per cent.
Vegetative progeny No. 4	25.29	25.68
-do- -do- No. 5	23.05	23.15

Similarly to *D. malaccensis* var. *sarawakensis*, the close agreement in both cases tends to show that the combined effect of a variation in the proportions of different sized roots and in the ether extract for each size of root is too small to account for the wide difference which may be found between the figures for ether extract for roots from two plants of the same progeny selected at random.

(d) *Variations in Rotenone Content of Root from Plants of Different Ages.*

As explained in the case of *D. malaccensis* var. *sarawakensis*, only the results obtained with chloroform extraction at room temperature will be mentioned. Consideration is therefore restricted to the figures obtained with plants aged 24 and 34 months respectively.

As in the case of ether extract, the results indicate the possibility of a wide difference in rotenone content between any two members of a vegetative progeny selected at random.

Table XVIII illustrates the range of variation found with plants of the ages mentioned above. Thus, in the case of the vegetative progeny of plant No. 17, aged 24 months, on the Raub Series soil there is a difference of about 2 per cent. between the maximum and minimum figures, plants Nos. 5 and 8 respectively.

There may also be wide variations between the average figures for rotenone for the same number of individual members of one vegetative progeny grown on different types of soil. This is illustrated in the case of the vegetative progeny of plant No. 17 at 24 months old and of plant No. 9 at 34 months old. In the first case there is a difference of about 1.5 per cent. in the figures and in the second one of nearly 2.5 per cent. In both cases the figures for the Raub Series soil are lower.

Table XVIII.

Rotenone Content of Marketable Root from Individual Plants of *Derris elliptica*, Sarawak creeping, at Varying Ages on Different Types of Soil at Serdang.

(Moisture-free basis)

Parent Plant No.	Serial No. of Vegetative Progeny	Age of Plants	Nature of Soil	
			Valley Quartzite	Raub Series
		months	per cent.	per cent.
	3		7.68	5.89
	4		6.08	5.49
	5		7.80	5.02
7	6	24	5.78	5.89
	7		7.02	6.05
	8		5.75	6.35
	9		7.08	5.38
	10		5.47	5.98
	Maximum		7.80	6.35
	Minimum		5.47	5.02
	Average		6.58	5.76
	1		8.76	7.06
	2		8.52	6.75
	3		8.41	7.11
17	4	24	7.65	6.18
	5		7.50	7.12
	6		8.58	6.48
	7		7.33	6.55
	8		8.73	5.15
	Maximum		8.76	7.12
	Minimum		7.33	5.15
	Average		8.19	6.55
	5		8.55	7.05
	6		8.99	5.06
9	7	34	9.25	5.79
	8		7.80	5.70
	9		7.72	5.98
	10		7.94	6.28
	Maximum		9.25	7.05
	Minimum		7.72	5.06
	Average		8.37	5.98
	1		8.93	6.98
	2		8.31	8.06
	3		8.06	8.34
31	4	34	7.30	6.76
	5		7.28	7.85
	6		8.84	8.16
	Maximum		8.93	8.34
	Minimum		7.28	6.76
	Average		8.12	7.69

(e) *Correlation between Rotenone Content and Ether Extract.*

Compared with *D. malaccensis* var. *sarawakensis* there is a narrower range of variation as regards the proportion which the amount of rotenone bears to the ether extract.

Table XIX.

Relationship between Rotenone and Ether Extract for Marketable Root of *Derris elliptica*, Sarawak creeping, on Different Types of Soil at Serdang.

(The figures for rotenone and ether extract are calculated on a moisture-free basis.)

Parent Plant No.	Serial No. of Vegetative Progeny	Age of Plants	Nature of Soil					
			Valley Quartzite			Raub Series		
			Rotenone	Ether Extract	Proportion of Rotenone to Ether Extract	Rotenone	Ether Extract	Proportion of Rotenone to Ether Extract
		months	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.
17	1	24	8.76	27.98	31.3	7.06	21.51	32.8
	2		8.52	26.52	32.1	6.75	20.45	33.0
	3		8.41	26.18	32.1	7.11	23.43	30.4
	4		7.65	23.81	32.1	6.18	20.54	30.1
	5		7.50	24.48	30.6	7.12	22.13	32.2
	6		8.58	26.85	32.0	6.48	20.61	31.4
	7		7.33	22.69	32.3	6.55	22.60	29.0
	8		8.73	28.54	30.6	5.15	17.72	29.1
	Maximum		8.76	28.54	32.3	7.12	23.43	33.0
	Minimum		7.33	22.69	30.6	5.15	17.72	29.0
	Average		8.19	25.88	31.7	6.55	21.12	31.0
31	1	34	8.93	27.26	32.8	6.98	21.74	32.1
	2		8.31	26.51	31.4	8.06	25.05	32.2
	3		8.06	25.92	31.1	8.34	25.65	32.5
	4		7.30	23.43	31.1	6.76	19.31	35.0
	5		7.28	23.40	31.1	7.85	23.93	32.8
	6		8.84	28.00	31.6	8.16	25.58	31.9
	Maximum		8.93	28.00	32.8	8.34	25.65	35.0
	Minimum		7.28	23.40	31.1	6.76	19.31	31.9
	Average		8.12	25.75	31.5	7.69	23.54	32.8

Table XIX shows the figures obtained with individual members of two vegetative progeny growing on the two types of soil. Thus, in the case of the vegetative progeny of plant No. 17, aged 24 months, the figures vary only from 32.3 to 30.6 per cent. for the Valley Quartzite soil and from 33.0 to 29.0 per cent. for the Raub Series soil. The average figure in both cases is also of the same order, 31.7 compared with 31.0 per cent.

It is interesting to note that the average figures for the proportion of rotenone to ether extract are again slightly higher at 34 months than at 24 months. This increase is noticeable in the case of both types of soil as the figures in Table XX show.

Table XX.

Proportion of Rotenone to Ether Extract for Marketable Root of *Derris elliptica*, Sarawak creeping, on Different Types of Soil at Serdang.

Age of Plants	No. of Plants	Nature of Soil					
		Valley Quartzite			Raub Series		
		Maximum	Minimum	Average	Maximum	Minimum	Average
months		per cent.	per cent.	per cent.	per cent.	per cent.	per cent.
24	16	32.8	28.9	30.9	33.0	28.7	30.5
34	12	33.3	31.1	31.9	35.5	30.6	32.8

Summary of Results of Investigation.

The results of the investigation may be summarized as follows:—

(a) *Yield of Root.*

(i) The average weight of root from an individual plant of a vegetative progeny in the case of both species is much greater than that of the parent plant at the same age. The increase can doubtless be attributed to the wider spacing.

(ii) Wide variations are found at all ages between the weights of root from individual plants of the same vegetative progeny under the conditions of the experiment.

(iii) These variations apply equally to both species, also to the two types of soil on which the experiment has been carried out.

(iv) The yield of root increases with the age of plant. In the case of *D. malaccensis* var. *sarawakensis*, the yield tends to remain stationary after 24 months, but with *D. elliptica*, Sarawak creeping, a gradual increase is shown up to 34 months.

(v) *D. elliptica,* Sarawak creeping, gives a markedly greater yield of root per plant at all ages than *D. malaccensis* var. *sarawakensis*. The former species would appear to be characterized by a marked root development.

(b) *Variation in Character of Root.*

There may be wide variations in the character of the root from individual plants. These variations are more marked with *D. elliptica,* Sarawak creeping, than with *D. malaccensis* var. *sarawakensis*.

(c) *Ether Extract of Root.*

(i) The development of toxicity takes place at a much earlier age than previously anticipated. Thus, the proportion of ether extract in the root of a parent plant aged 24 months may be less than that of its vegetative progeny aged 13 months.

(ii) Wide variations may exist in ether extract between a parent plant and any member of its vegetative progeny, also between any two members of the progeny selected at random. The difference may be of the order of 10 per cent.

(iii) These variations apply equally to both species and to the two types of soil.

(iv) The ether extract varies with the size of root. In the case of *D. malaccensis* var. *sarawakensis* the ether extract decreases with decreasing size of root; with *D. elliptica,* Sarawak creeping, the roots varying in diameter from $\frac{1}{4}$ to $\frac{1}{8}$ in. diameter have the highest ether extract, followed by those $\frac{1}{2}$ to $\frac{1}{4}$ in. The roots having a diameter of $\frac{1}{8}$ in. and less are lowest in ether extract.

(v) The differences in ether extract between different sized roots combined with the variations in character between the roots of individual plants are, however, insufficient to account for the wide variations referred to above.

(vi) In the case of *D. malaccensis* var. *sarawakensis* the average figure for ether extract for any vegetative progeny up to 24 months was slightly higher than that for the parent plant at 24 months. After 24 months there was a tendency for the ether extract to decrease. These observations apply to both types of soil. For *D. elliptica,* Sarawak creeping, the average figure for any vegetative progeny was less than that for the corresponding parent plant. This decrease was more marked in the case of the Raub Series soil than for the Valley Quartzite soil. There was no tendency for the ether extract to decrease with increasing age of plant.

(d) *Rotenone Content of Root.*

(i) Comparative figures for rotenone for parent plant and vegetative progeny are not available owing to the unreliability of the method previously used. A description is given of the revised method which gives consistent results.

(ii) Similarly to ether extract, the results indicate the possibility of a relatively wide difference in rotenone content between any two members of a vegetative progeny selected at random. The difference is more marked with *D. malaccensis* var. *sarawakensis* than with *D. elliptica,* Sarawak creeping, even though the proportion of rotenone to ether extract is less for the first than for the second species.

(iii) There may also be relatively wide variations between the average figures for rotenone for the same number of members of one vegetative progeny grown on the two types of soil. In both cases the figures for the Raub Series soil are slightly lower.

(e) *Proportion of Rotenone to Ether Extract.*

(i) In the case of *D. malaccensis* var. *sarawakensis* there was a wide range of variation in the proportion of rotenone to ether extract between the individual members of a vegetative progeny irrespective of type of soil. The range of variation was much narrower for *D. elliptica,* Sarawak creeping.

(ii) For plants aged 24 months, the average figures for the proportions of rotenone to ether extract were as follows:—

	per cent.
D. malaccensis var. *sarawakensis*	14.4
D. elliptica, Sarawak creeping	30.7

(iii) There appeared to be a slight tendency for the proportion of rotenone to ether extract to increase with increasing age of plant.

No explanation can yet be offered to explain the variations both in yield of root and toxic content.

From the point of view of these characteristics the results demonstrate again the potential value of *D. elliptica,* Sarawak creeping, as a satisfactory type for planting on a large scale.

The above type, which is characterized by a high yield of root combined with medium rotenone and ether extract, meets the present demand both of the English and American markets.

In spite of the variations, the results show that the average figure for rotenone, calculated on a 10 per cent. moisture basis (this figure represents the average moisture content of well-dried commercial consignments of root), would be well in excess of 5 per cent. The latter figure is the minimum on which root can be offered on a rotenone basis. A figure of 5 per cent. on a 10 per cent. moisture basis is equivalent

to 5.56 per cent. on a moisture-free basis. Reference to Table XVIII will show that the average figure for any group of plants on either type of soil is in excess of this figure.

The figures for rotenone for *D. malaccensis* var. *sarawakensis*, are too low to admit of this type of root being sold on this basis. It can be sold only on a basis of ether extract.

At present, a much lower price is offered for root sold on an ether extract basis compared with a rotenone basis. The latest average Singapore prices are $8 (Straits currency) per picul (133⅓ lbs.) for root sold on an ether extract basis compared with $18 per picul for root sold on a rotenone basis.

Outline of Further Work.

While the isolation of a clone in which high yield of root is combined with high toxic content still remains the final objective of the work, the application of the results of the investigation to present estate practice must not be overlooked.

The multiplication of stocks of high-quality planting material derived both from individual plants and from mixed vegetative progeny of an individual plant of similar quality is therefore being undertaken.

For example, in the case of *D. malaccensis* var. *sarawakensis* cuttings from an individual plant which gave the following figures at 24 months have been established.

	ozs.
Weight of air-dry marketable root	34.74
	per cent. (Moisture-free basis)
Rotenone	4.58
Ether extract	32.76

Similarly for *D. elliptica*, Sarawak creeping, cuttings from a group of mixed vegetative progeny which gave the following average figures at 24 months have also been established. The vegetative progeny were all derived from a single parent plant.

	ozs.
Weight of air-dry marketable root	23.04
	per cent. (Moisture-free basis)
Rotenone	7.78
Ether extract	24.73

With regard to estate practice the important lines of work are as follows:—

(a) Yields of root at different ages with varying planting distances.

(b) Average toxic content of root at different ages with varying planting distances.

(c) The extent to which a decrease in the toxic content of the roots of plants in one generation is likely to be maintained in the next generation.

The last line of work applies more particularly to *D. elliptica*, Sarawak creeping, in which the figure for the average toxic content of a vegetative progeny was invariably less than that for the parent plant.

Experiments on these lines have been and are being laid down with planting material of toxic content of known limits.

As indicated previously, no explanation can at present be offered for the wide variation in the figures for the yield of root and toxic content of members of a vegetative progeny. Following a suggestion by Dr. T. W. Brown, Botanist, small-scale experiments are being laid down to ascertain whether these characteristics are influenced by the size of the original cutting.

Acknowledgments.

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APPENDIX 'A.'

Method for Estimation of Rotenone.

Thirty grammes of the finely powdered root are placed in a bottle, 300 cc. of chloroform added and the bottle with the contents is shaken mechanically for two hours. An end-over-end type of shaker is preferable so as to ensure thorough mixing of the powder and solvent.

The bottle is allowed to stand overnight and shaken for a further hour in the morning.

The mixture is filtered as rapidly as possible, using a filter large enough to hold the whole bulk, and 200 cc. of the filtrate are collected in a graduated flask. The filter is covered with a clock glass to prevent evaporation of the chloroform during the operation.

The above volume of filtrate, which is taken to contain the extract of 20 gm. of root, is distilled on a steam-bath to a small volume and the remainder of the solvent is removed under reduced pressure.

The residue is dissolved in 10 cc. of warm carbon tetrachloride, which is distilled off under reduced pressure. This procedure is repeated a second time to ensure complete removal of chloroform.

Twenty-five cc. of carbon tetrachloride, saturated with rotenone at the temperature of the Electrolux cold cabinet, are added to the residue, which is dissolved by warming.

The hot solution is transferred to a small wide-mouthed flask, the distillation flask rinsed with a few cc. of carbon tetrachloride and the rinsings transferred to the wide-mouthed flask.The final volume of liquid in the flask is adjusted to 25 cc. by distillation.

In the case of root in which the rotenone content is known to be of the order of 6 per cent. or less, *e.g. Derris malaccensis,* Kinta type, *D. malaccensis* var. *sarawakensis* or *D. elliptica,* Sarawak creeping, 1 gm. of pure rotenone is placed in the small wide-mouthed flask before the contents of the distillation flask are transferred thereto. An allowance must be made for this rotenone in the final calculation.

The flask is closed with a cork and transferred to the Electrolux cold cabinet. It is stored for two days, during which period the rotenone-carbon tetrachloride complex crystallizes.

The complex is filtered on a Gooch crucible, fitted with a paper disc, and washed with ice-cold carbon tetrachloride saturated with rotenone. About 15 cc. of the solvent are used.

After standing in the air for three or four hours the complex in the crucible is broken up by means of a spatula to accelerate drying.

The volume of the mother liquor and washings is reduced to 15 cc. by distillation and, after seeding with rotenone, the flask is corked and returned to the cold cabinet for one day. A second crop of complex crystals separates and is filtered on a Gooch crucible fitted with a paper disc.

The complex from the second crystallization is allowed to dry as described previously and added to that originally obtained. The total weight of air-dry complex is recorded.

The complex is triturated with alcohol (saturated with rotenone at the ordinary temperature) in the proportion of 5 cc. of alcohol for each gramme of complex.

The mixture is left to stand overnight before filtering on a Gooch crucible fitted with a paper disc.

The rotenone is dried in the steam-oven and weighed; it should be broken up after one hour's drying, thereby reducing the period required to complete this operation.

A deduction of ~~0.7~~ 0.07 gm. of rotenone must be made in all cases in respect of the excess rotenone in the second crop of complex consequent upon the reduction of the volume of 40 cc. of carbon tetrachloride saturated with rotenone to 15 cc.

CONDITIONS ON RUBBER SMALL HOLDINGS IN MALAYA.

2nd Quarter, 1939.

Prepared by the Economics Branch of the Department of Agriculture, S.S. and F.M.S., in collaboration with the Field Branch of the Department.

Rainfall.

During the first two months of the quarter under review normal rainfall was experienced in most parts of the Peninsula, and June was a dry month. In Kedah, Province Wellesley and Penang, the dry weather experienced during the first quarter extended into April, but in the latter Settlements abnormally heavy rains fell in May and June. The quarter was exceptionally dry in Malacca with the exception of the Central District which experienced a wet May. In Johore Central, June rainfall was above the average, and similar conditions were experienced in the inland districts of Pahang.

Prices.

Prices paid for small-holding rubber during the quarter are summarized in Tables I and II.

The value of coupons continued high, rising from $26.50 in April to $28.80 in May and falling in June to $27.50 per picul equivalent. In Kelantan coupons were considerably lower, ranging from $20.60 to $23.15, and in Kedah they ranged from $24 to $27.50. Uncouponed rubber varied from $5 per picul at the beginning of April to $7 at the close of the quarter. In Penang it rose to $15 per picul in May (Province Wellesley $10), but fell back to $7 in June.

Production.

Table III gives production of rubber on small holdings during the quarter. Small-holding production was 30 per cent. of the total production of the quarter, whereas small holdings represent 39 per cent. of the total planted area of rubber in Malaya.

Quality of Rubber.

The Selangor report states that rubber is now mostly prepared in the form of reasonable quality smoked sheet. There are now 30 members participating in a co-operative smoke house at Ijok, and a new smoke house on a similar basis has been constructed at Sijangkang. Other individual smoke houses have been erected in the State during the quarter.

The Pahang report stresses the fact, previously referred to in these summaries, that good quality smoked sheet from small holdings is dependent upon a sufficiently high premium being forthcoming. The report states that the quality of sheet entered

Table I.

Highest and Lowest Rubber Prices Paid by Local Rubber Dealers.

(In Straits dollars per picul of 133 1/3 lbs.)

2nd Quarter 1939.

	Penang	Perak	Selangor	Negri Sembilan	Pahang	Malacca	Kedah	Johore
				APRIL				
Smoked sheet	34.00-36.50	28.80-34.70	32.00-35.00	32.00-34.00	29.00-36.25	34.00-35.50	32.00-36.00	30.70-36.00
Unsmoked sheet	32.00-35.50	25.50-33.50	31.00-33.80	30.00-33.50	28.50-34.00	33.00-34.50	30.50-35.00	30.00-36.20
Scrap	22.00-28.50	27.00-27.50	27.40-28.00	—	—	28.00-30.00	27.00-29.00	25.00-30.00
				MAY				
Smoked sheet	34.00-36.00	32.00-35.70	33.00-35.80	33.00-35.20	30.00-35.50	34.00-35.50	31.00-36.40	32.50-35.50
Unsmoked sheet	32.00-35.50	30.00-35.00	30.00-34.00	31.00-34.70	29.00-33.50	32.00-34.50	31.00-35.40	29.50-34.80
Scrap	23.00-28.50	26.00-29.00	27.20-29.10		—	28.00-30.50	26.50-29.40	26.80-30.00
				JUNE				
Smoked sheet	34.00-36.00	32.00-36.00	30.80-36.25	32.00-36.10	31.25-40.00	35.00-36.50	32.90-37.50	33.00-36.00
Unsmoked sheet	33.00-36.00	30.50-35.00	29.00-35.10	31.00-35.00	31.00-34.00	34.00-35.50	32.50-36.50	32.00-35.00
Scrap	23.50-27.50	26.00-28.00	28.50-30.50	—	—	29.00-33.00	28.00-30.10	27.50-31.00

Table II.

Mean of Highest and Lowest Rubber Prices Paid by Local Dealers at a number of Centres in each State.

(In Straits dollars per picul of 133 1/3 lbs.)

2nd Quarter 1939.

	Penang	Perak	Selangor	Negri Sembilan	Pahang	Malacca	Kedah	Johore
				APRIL				
Smoked sheet	34.25-36.10	32.32-34.08	33.02-34.13	32.30-33.70	31.80-33.53	34.17-35.00	32.62-34.50	32.39-34.11
Unsmoked sheet	32.88-35.00	30.55-32.33	31.10-32.53	30.90-32.70	30.30-31.45	33.17-34.00	31.28-32.88	31.14-33.34
Scrap	24.95-26.50	27.00-27.50	27.40-28.00	—	—	28.17-29.33	27.17-28.33	26.96-28.29
				MAY				
Smoked sheet	34.00-35.55	33.39-34.65	34.12-35.06	33.38-35.04	32.89-34.16	34.17-35.33	32.92-35.00	33.17-34.72
Unsmoked sheet	32.88-34.55	32.13-33.55	31.35-32.94	32.00-33.92	31.40-32.18	32.83-34.17	31.32-33.30	31.73-33.42
Scrap	25.50-26.67	26.00-29.00	27.20-29.10	—		28.50-30.00	27.20-28.13	28.15-29.15
				JUNE				
Smoked sheet	34.25-36.00	33.87-35.58	33.93-35.62	33.80-35.32	33.59-35.59	35.33-36.33	34.60-35.70	34.41-35.15
Unsmoked sheet	33.88-35.18	32.38-33.90	31.38-33.65	32.70-34.50	32.20-33.40	34.50-35.33	33.62-34.75	32.83-34.39
Scrap	25.25-25.75	26.00-28.00	28.50-30.50	—	—	30.50-31.83	28.33-29.37	28.72-30.05

Table III

Production of Rubber on Small Holdings.

(in tons)

	Total First Half-Year 1938	1st Quarter 1939	2nd Quarter 1939	Total First Half-Year 1939
Federated Malay States ...	33,650	10,875	9,729	20,604
Straits Settlements ...	6,298	2,123	2,054	4,177
Unfederated Malay States ...	30,788	11,450	10,562	22,012
TOTAL MALAYA ...	70,736	24,448	22,345	46,793

in the mukim rubber competitions shows clearly that small-holders know how to make good quality sheet rubber, but that, at the present time, the economic incentive is lacking. The report adds, however, that although many of the smoke houses are not in regular use, ten new cabinets were erected during the quarter.

In Kelantan there are now 26 smoke cabinets, while nine are under construction and twenty awaiting construction; approximately twelve of these smoke houses are worked or will be worked co-operatively. The premium in this State for good F.A.Q. smoked sheet has been from $2.50 to $3 per picul throughout the quarter.

In Taiping, Perak, smoked sheet has received a premium of $2 per picul, and three new smoke cabinets have been erected, while existing ones have remained in operation.

In Perak North no smoking was carried out during the first two months of the quarter owing to continued wet weather and padi harvesting. In Perak South three demonstration cabinets were erected in April.

General Conditions on Holdings.

Conditions on small holdings continue to be reasonably satisfactory. Many Chinese owners are clean weeding and eradicating *lalang* grass. In general it appears that it is only the fear that their coupon allowance may be reduced which makes most small-holders carry out weeding or slashing of undergrowth.

Soil erosion on hilly areas is receiving special attention in view of the new planting and replanting now permitted.

Tapping.

The result of the quarterly survey of areas of small holdings out of tapping is summarized in Tables IV and V, and it will be seen that in most States the number of areas not in tapping increased, but the increase for the whole of Malaya was only 1 per cent., *i.e.* from 42 per cent. in March to 43 per cent. in June.

Table IV.

Estimated Acreage of Tappable Rubber which was out of Tapping on Holdings of less than 100 Acres at the end of June, 1939.

PERAK				SELANGOR				NEGRI SEMBILAN				PAHANG			
District	Total Tappable area	Total area untapped	Percentage	District	Total Tappable area	Total area untapped	Percentage	District	Total Tappable area	Total area untapped	Percentage	District	Total Tappable area	Total area untapped	Percentage
Batang Padang	30,187	12,300	34	Klang	16,143	10,500	65	Seremban	23,639	21,700	92	Raub	10,534	9,300	88
Kinta	38,874	7,800	20	Kuala Langat	23,881	12,200	51	Tampin	21,896	18,200	83	Kuala Lipis	15,457	5,700	37
Kuala Kangsar	92,166	68,200	74	Ulu Langat	45,012	27,900	62	Kuala Pilah	31,832	24,500	77	Bentong	12,224	3,200	26
Upper Perak	15,590	5,900	38	Ulu Selangor	31,463	16,000	51	Jelebu	9,097	1,600	18	Other Districts†	40,373	22,300	48
Larut & Selama	43,132	4,300	10	Kuala Lumpur	20,277	14,400	71	Port Dickson	11,133	10,900	98				
Krian	9,408	8,400	89	Kuala Selangor†	8,417	5,000	59								
Lower Perak*	26,735	19,800	74												
Dindings	9,873	8,000	81												
	271,965	134,700	50		145,193	86,000	59		97,597	76,900	79		84,588	40,500	48

MALACCA				PENANG & P. WELLESLEY				SINGAPORE			
District	Total Tappable area	Total area untapped	Percentage	District	Total Tappable area	Total area untapped	Percentage	District	Total Tappable area	Total area untapped	Percentage
Central	14,093	5,900	42	North	3,549	2,400	69	Singapore	20,115	1,200	6
Alor Gajah	30,838	19,700	64	Central	10,785	5,600	52				
Jasin	25,286	8,300	33	South	8,936	5,900	66				
				Penang	15,822	800	5				
	70,217	33,900	48		39,092	14,700	38		20,115	1,200	6

JOHORE	350,007	91,000	26
KEDAH	102,126	42,900	42
KELANTAN	49,133	7,400	15
PERLIS	2,916	14,100	43
TRENGGANU	29,836		

The percentage of areas out of tapping in March, 1939, was as follows:—Perak 50, Selangor 51, Negri Sembilan 72, Pahang 42, Malacca 50, Penang and Province Wellesley 42, Singapore 3, Johore 20, Kedah 59.

* Estimated from percentage for Kuala Kangsar.

†Estimated from percentage for other Districts in the State.

‡Estimated from percentage for rest of Malaya.

Table V.

Comparisons of Areas of Rubber Small Holdings Out of Tapping.

	June, 1938		March, 1939		June, 1939	
	Acres	Per-centage	Acres	Per-centage	Acres	Per-centage
F.M.S. ...	239,300	39.9	315,500	52.6	338,100	56.4
S.S. ...	43,700	25.3	51.900	40.0	49,800	38.5
U.M.S. ...	147,600	27.6	164,700	30.8	155,400	29.1
Malaya ...	419,600	33.2	532,100	42.0	543,300	43.0

In some localities tapping ceased during April and May owing to padi harvesting and heavy rains and recommenced in the second half of June.

In Kelantan, with the end of the padi harvest tapping was recommenced in many areas, the percentage of holdings out of tapping falling from 41.4 per cent. in March to 15.2 per cent. in June.

Planting.

As the result of advice and propaganda by Departmental officers and Asiatic Rubber Instructors considerably more interest is now being taken in the possibilities of replanting and new planting.

In Selangor, following a tour of the Rural Lecture Caravan, such interest has been particularly in evidence; it is not intended that, once aroused, it should be allowed to flag, and a further series of lectures has been arranged in connexion with the forthcoming mukim council meetings in August.

In Perak South three multiplication nurseries have been established and approximately 940 budded stumps planted. These nurseries will supply budwood to 18 small-holders for the budding of 90 acres of new or replanted rubber. Several other small-holders also wish to establish nurseries.

The Pahang report states that during the quarter there has been a good deal of activity in new planting and replanting. The use of approved planting material was strongly urged, and it is thought that considerable budding will be carried out in 1940. Demonstrations of budding in order to familiarize small-holders with the technique have been given at many centres, and some small-holders have already laid down multiplication nurseries.

The Kelantan report, on the contrary, states that replanting continues to hold no attraction for the small-holder and there has been no response to propaganda on the subject. Similarly with regard to new planting most small-holders appear to have sold their share certificates, and developments in this direction will accordingly be limited.

In Penang and Province Wellesley over 200 small-holders (over 50 per cent. Chinese) are undertaking new planting. Unfortunately some very unsuitable sites have been chosen, and in Province Wellesley a number of Malays have planted on silted-up padi land. In addition to the fact that the soil is so poor that practically nothing will grow, further silting occurs at flood times, and during rains in May the seedlings on a recently planted holding of this type were completely buried by a further deposit of silt from the hills behind.

Pests and Diseases.

Mouldy Rot (*Ceratostomella fimbriata*) was again the most prevalent disease attacking small holdings but control was effected with approved fungicides.

Oidium Heveae was prevalent throughout the Perak South Circle, and in some localities up to 10 per cent. of the trees were affected. In the same report it is stated that during the usual quarterly observations on the spread of root disease it was found that, in six 1 acre lots, there were nine fresh cases of infection.

Giant snails were troublesome on young rubber and cover crops and the use of "Meta" bran mixture was recommended.

Root diseases have been prevalent in Malacca, but, due to the work of Asiatic Rubber Instructors, control measures are now carried out more satisfactorily than formerly.

Oidium Heveae was prevalent in several districts of Johore at the beginning of the quarter but the infection was of a mild nature and the trees soon recovered from the attack.

General.

The practice of selling coupons upon issue and tapping only when additional money is needed appears to be the general procedure among small-holders. One small-holder is said to have described his coupons as "*macham* pension."

There is no tendency to abandon rubber for other crops, but rather the reverse, as there are few other crops which hold equal economic possibilities.

On the other hand, according to the Pahang report there is greater attention being paid to growing foodstuffs in view of the international situation, and all Government officers who have occasion to visit the rural areas have explained the position, and strongly urged steps to ensure a sufficient supply of foodstuffs for self-support. There has been a satisfactory response, and enquiries about growing foodcrops on newly-felled and on cut-out areas have been received.

In one district in Johore a Singapore company has opened an agency for the purchase of latex from small-holders, and it is considered that this method of disposing of their produce is likely to appeal to Malay small-holders.

The Johore report also mentions that small-holders are now planting more padi and foodstuffs than they have done for several years, and in consequence their economic position is gradually improving.

During the quarter several District Rubber Shows were held in various parts of the country in connexion with the All-Malayan Small-Holders' Rubber Competition and the quality of exhibits was very high though the number of entries at certain Shows was disappointing.

Departmental.

FROM THE DISTRICTS.

Compiled by the Chief Field Officer from Monthly Reports of Agricultural Officers.

July, 1939.

The Weather.

The weather has been abnormally hot and dry, even for July. Rainfall recorded at various meteorological stations has been in many cases only a fraction of the small normal amount for this month. It is fortunate that heavy rainfall occurred in June in many parts of the country, so that there have been sufficient supplies of water in most districts to tide over the dry period. Towards the end of the month falls of rain occurred in many places and there were signs that the dry spell was breaking.

Crop Reports.

Rubber.—The extremely hot dry weather is causing a secondary "wintering" in many districts, and the crop has also been very much reduced. Prices have continued to appreciate a little. Rubber without coupons has made a fair gain in price, $8.50 to $9 per picul now being quoted. The value of coupons on the other hand has depreciated. This price movement can be attributed to the present reduced crop and also to the effect of the increase in quota for the 2nd and 3rd quarters of the year to 60 per cent.

Small-holders are showing an increasing interest in replanting their holdings. They have taken a long time to realize that, with present market conditions, they can carry out replanting with very little reduction resulting in their income. If the value of coupons should depreciate markedly—as is likely to happen if the quota release is increased greatly—they will unfortunately not be in such a satisfactory position. In Kelantan, where up to the present small-holders have shown little interest in replanting, a number of Malays have now started to replant their holdings. Others will no doubt follow their lead. The Asiatic Rubber Instructors are doing valuable work in arousing interest in replanting and new planting. In Negri Sembilan it is reported that little difficulty is being experienced in persuading small-holders to plant when necessary on contour terraces.

In Klang District the Co-operative Marketing Officer on seven occasions arranged the sale of small-holders' rubber direct with an agency house in Klang. One hundred and sixty-four piculs were sold in this way and the price realized was about $1.07 per picul above the price offered by the local Chinese dealers.

Padi.—As might be expected the dry weather has held up padi cultivation. In irrigation areas, except on some of the higher land, water supplies were usually adequate. The smaller padi areas, which are mainly dependent on rain for their water supplies, felt the drought worst.

In Malacca the weather has been most unfavourable for padi planting this season. In June there was very little rain, though planters in the inland districts had sufficient water to make a start with cultivation. In July the coastal areas had no water at all and supplies in the inland districts were failing. This year planting in the coastal areas is bound to be very late and the outlook at present is certainly not hopeful.

Fruit.—A fair quantity of fruit is now coming into the markets in most parts of the country, consisting in the main of rambutan, langsat, mangosteen and durians.

There has been an exceptionally heavy crop of fruit this year in North Kedah. Huge quantities of durians were brought into the Weekly Fairs and a large amount was sold to middlemen for export. Rambutan, mangosteen and langsat have also been in season. The Weekly Fairs play an important part in helping to dispose of these heavy crops which would otherwise give rise to severe glutting in the main producing localities.

FERTILIZER PRICES, AUGUST, 1939.

The following are the prices current for the month of August, 1939, of some of the more important fertilizers.

Product.	Analysis				Price per ton $
	Nitrogen (N)	Phosphoric Acid (P_2O_5)		Potash (K_2O)	
		Soluble	Insoluble		
Sulphate of Ammonia ...	20.6	—	—	—	72.75
Calcium Cyanamide ...	20.6	—	—	—	80.00
Muriate of Potash ...	—	—	—	50	112.00
Sulphate of Potash ...	—	—	—	48	112.00
Superphosphate (concentrated) ...	—	39	—	—	105.00
Superphosphate ...	—	16-18	—	—	60.00
Basic Slag ...	—	—	16	—	48.00
Rock Phosphate (Christmas Island) ...	—	11*	38‡	—	33.50
Rock Phosphate (very finely ground Gafsa) ...	—	11*	26 - 28‡	—	40.00
Lime ...	—	—	—	—	20.00

* Citric soluble. ‡ Total

Quotations are *ex* warehouse, Port Swettenham, Klang, Singapore and Penang, with the exception of muriate of potash which is *ex* warehouse, Port Swettenham, Klang and Singapore.

The above quotations for concentrated superphosphate, superphosphate and Christmas Island phosphate are *ex* warehouse Penang, Port Swettenham and Klang. The Singapore quotations for these three fertilizers are $95, $50 and $31.50 per ton respectively.

DEPARTMENTAL NOTES.

Appointment of Adviser on Agriculture.

Mr. W. N. C. Belgrave, Acting Adviser on Agriculture, has been promoted in the Colonial Agricultural Service to be Director of Agriculture, Straits Settlements, and Adviser on Agriculture, Malay States, with effect from the 1st January, 1939.

Leave.

Mr. R. A. Altson, Plant Pathologist, has been granted 211 days leave from 15th July 1939.

Mr. W. J. B. Johnson, Canning Officer, has been granted 227 days leave from 15th July, 1939. During Mr. Johnson's absence Mr. F. C. Cooke, Chemist, Coconut Products, has proceeded to Johore to take over his duties.

MEETING OF THE AGRICULTURAL ADVISORY COMMITTEE, 12th JULY, 1939.

A meeting of the Agricultural Advisory Committee was held at the Department of Agriculture, Kuala Lumpur, on 12th July, 1939, under the chairmanship of the Hon'ble the Acting Adviser on Agriculture, Malay States.

Amongst subjects discussed were tea restriction and local China tea manufacture; derris; analysis of rice samples with regard to nutritive value; yields of nuts from young coconut areas; legislation to control the export of planting material. In addition to the foregoing and routine matters the following subjects of importance were dealt with.

Pineapple Industry.

The Chairman reported that, accompanied by the Chief Field Officer, he had recently made a personal inspection of the demonstration factory at Johore Bharu and considered the installation to be highly satisfactory.

Rubber.

The Department now has a total of 11 acres on Agricultural Stations throughout the country planted with budwood nurseries to meet the requirements of small-holders for budwood. The possibility of the purchase of budded stumps for small-holders is being considered by the Rubber Research Institute of Malaya.

Manila Hemp.

The Chairman stated that the Manila hemp machinery at the Central Experiment Station, Serdang, was working satisfactorily. The crop has been planted at various Agricultural Stations throughout the country in order to obtain information regarding yields under various soil conditions.

Statistical.

MARKET PRICES.

July 1939.

Major Crops.

Rubber.—There was little fluctuation in the rubber market during July, No. 1. X. Ribbed Smoked Sheet, loose, opened at 28⅛ cents per lb., and closed at 28½ cents, the range for the month being from 28 to 28⅝ cents. The average of daily quotations for the month was 28.27 cents per lb., as compared with 28.53 cents in June. The London average price was 8.27 pence per lb., and New York 16.44 cents gold, as compared with 8.24 pence and 16.31 cents gold in June.

Prices paid for small-holders' rubber at three centres during the month are given in Table I.

Table I.

Weekly Prices Paid by Local Dealers for Small-Holders' Rubber, July, 1939.

(Dollars per picul of 133 1/3 lbs.)

Grades	Kuala Kangsar, Perak		Kuala Pilah, Negri Sembilan			Batu Pahat, Johore.			
	12	19	6	13	20	5	12	19	26
Smoked Sheet ...	35.00	—	35.00	—	35.20	—	34.60	34.81	34.56
Unsmoked Sheet ...	—	34.00	34.00	34.00	34.00	33.46	33.58	34.17	—
Scrap ...	—	—	28.00	—	—	—	—	—	—

Transport by F.M.S.R. lorry service Kuala Pilah to Seremban 12 cents per picul, to Malacca excluding duty, 25 cents per picul, by rail Seremban to Penang $1.24 per picul, Seremban to Singapore $8.00 per ton.

Transport from Batu Pahat to Singapore by lorry excluding duty, 90 cents per picul.

Transport from Kuala Kangsar to Prai by railway $6.20 per ton.

Transport from Kuala Kangsar to Singapore by railway $10.00 per ton (minimum consignment 5 tons).

At Kuala Pilah the standard deduction for moisture in unsmoked sheet is 5 per cent.

No purchases of rubber at Kuala Kangsar on the 5th and 26th July, and at Kuala Pilah on the 27th July.

Palm Oil.—Prices fell heavily, and the month's quotations are given in Table II. The averages of the June quotations were:—palm oil £13.7.6, kernels £8.16.11.

Table II.

Prices of Palm Oil and Palm Kernels.

Date 1939.	Palm Oil in Bulk, c.i.f. landed weight Liverpool/ Halifax.	Palm Kernels, c.i.f. landed weight London/ Continent
	per ton	per ton
July 7	£ 12. 15. 0 (nominal)	£ 8. 5. 0 Hamburg
,, 14	12. 5. 0 Liverpool	8. 5. 0 ,,
,, 21	12. 5. 0	8. 2. 6
,, 28	12. 5. 0 Liverpool	8. 0. 0 Hamburg
Average	£ 12. 7. 6	£ 8. 3. 1

Copra.—The market fell slightly during the month but shewed some improvement at the close. The sun-dried grade opened in Singapore at $3.75 per picul, fell to $3.50 on the 21st July, and closed at $3.60. The Singapore average price for the month was $3.59 per picul, as compared with $3.74 in June. The mixed grade averaged $3.24, as against $3.41 in June.

Copra cake improved to $2 per picul in the second half of the month, averaging $1.76 as compared with $1.60 in June.

Rice.—The Singapore average wholesale prices of rice per picul in June were as follows:— Siam No. 2 Ordinary $3.75, Rangoon No. 1 $3.40, Saigon No. 1 $3.35, as compared with $3.81, $3.22 and $3.47 in May, and with $4.25, $3.95 and $3.87 in June, 1398.

The average retail prices in cents per gantang (gallon) of No. 2 Siam rice were:— Singapore 26, Penang 32, Malacca 28, as compared with 27, 32 and 28 respectively in May.

The average declared trade value of imports during June was $3.68 per picul, as compared with $3.76 in May and $3.72 in April.

Padi.—The Government Rice Mills, Perak and Pahang, paid $2.20 per picul for padi. Retail prices per 100 gantangs (gallons) ranged from $8 to $12 in most parts of the country. In Kedah the price was $7.10 to $7.50, in Penang and Province Wellesley $8.70, in Krian $8, in Kelantan $8.80, and in Brunei $10 to $12. In Perak North the price was $12, in the Central Circle $9.69, and in the South Circle $7 to $14.

Pineapples.—Prices continued unchanged as controlled by the Central Board of Packers. Per case of 48 cans of 1½ lbs. each they were:—G.A.Q.: Sliced Flat $3.20, Sliced Tall $3.35, Cubes $3.25; Golden: $3.60, $3.75 and $3.65 respectively. Fresh fruit prices per 100 were as follows:—Singapore 50 cents to $1.80; Selangor $1 to $1.10.

Beverages.

Tea.—Two consignments of Malayan highland tea, comprising 130 packages, were sold on the London market during July at 1s. 3d. and 1s. 2¾d. per lb. Eight consignments of lowland tea, comprising 546 packages, were sold in London at prices ranging from 11½d. to 1s. 0½d., the average price being 11.94d.

The average London prices per lb. realized for tea from other countries, according to the *Tea Market Reports* for July of the Tea Brokers Association of London, were as follows:— Ceylon 1s.2.15d., Java 1s.0.40d., Indian Northern 1s.2.11d., Indian Southern 1s.0.86d., Sumatra 10.9d.

The latest Colombo prices available, quoted from *The Ceylon Tea Market Report* of 25th July, 1939, of the Colombo Brokers' Association, are as follows, in rupee cents per lb.:— High Grown Teas 79, Medium Grown Teas 72, Low Grown Teas 65.

Coffee.—Liberian coffee was quoted in Singapore throughout the month at $15 per picul. Excelsa opened at $10.25, but fell to $10 in the first half of the month. Robusta opened at $6.75, fell to $6.50, but rose again to close at $6.75.

The average of highest and lowest quotations in Singapore for Palembang coffee was $8.12 to $9.12 per picul, and for Sourabaya coffee $9.81 to $11.75.

Spices.

Arecanuts.—The averages of the Singapore Chamber of Commerce quotations per picul were:—Best $6.03, Medium $5.60, Mixed $5.09.

The averages of the highest and lowest quotations per picul in Singapore were as follows:—Splits $3.37 to $5.50, Red Whole $3.37 to $5.50, Sliced $7.94 to $10.37, as compared with $4.48 to $6.67; $5.10 to $6.75; and $8.76 to $11.93 in June.

Pepper.—The Singapore market continued unchanged at the June closing prices, which were as follows (per picul):—Singapore Black $7.25, Singapore White $11.25, Muntok White $11.50. The June average prices per picul were $7.44, $11.62 and $11.88 respectively.

Nutmegs.—The market remained unchanged, 110's and 80's both continuing at $28 per picul. Penang dried nutmegs were sold at $19 per picul.

Mace.—Siouw continued to be quoted nominally at $85 per picul, and Amboina fell from $58 to $53, averaging $55 per picul. Locally produced mace, dry, was sold in Penang at $67 per picul.

Cloves.—Nominal quotations in Singapore remained unchanged at $40 per picul for both Zanzibar and Amboina. Penang cloves, dried, sold in Penang at $45 per picul.

Cardamoms.—Green cardamoms were quoted in *The Ceylon Chamber of Commerce Weekly Report* for 31st July 1939, from Rs. 1.25 to Rs. 1.34 per lb.

Miscellaneous.

Derris.—There was again no change in Singapore prices of derris, and July quotations per picul were: roots sold on a basis of ether extract $7.50 to $9, and on rotenone content $17.50 to $18.50.

Gambier.—Singapore prices continued unchanged: Block $8 per picul nominal, and No. 1 Cube $17.

Sago.—Prices advanced during the month owing to speculative buying, but fell at the close and stocks in Singapore are heavy. Pearl averaged $4.09 per picul, and Flour, Sarawak Fair, averaged $2.49, as compared with $4.10 and $2.42 respectively in June.

Tapioca.—Singapore prices per picul were unchanged throughout the month: Flake Fair $4, Seed Pearl $4.50, Medium Pearl $5. The June average prices were $4.10, $4.85 and $5 respectively.

Tobacco.—Prices in Kelantan for prepared tobacco were higher during July: 1st quality $100 to $170, 2nd quality $75 to $130, 3rd quality $50 to $115 per picul. The general range of prices per picul was:—1st quality $22 to $28, 2nd quality $14 to $20, 3rd quality $6 to $14. The range in Kedah was $40, $25 and $17; in Penang and Province Wellesley $34.50, $27 and $20; in Pahang $13 to $28, $10 to $15, $5 to $12. In Malacca prices ranged from $14.50 to $16.50.

The above prices are based on London and Singapore daily quotations for rubber, on the Singapore daily prices for copra, on the Singapore Chamber of Commerce Weekly Reports for the month and on other local sources of information. Palm oil reports and certain coffee prices are kindly supplied by Guthrie & Co. Ltd., Kuala Lumpur, the Singapore prices of imported coffee and arecanuts by Lianqui Trading Company of Singapore, and Singapore derris prices by Hooglandt & Co., Singapore.

1 picul = 133 1/3 lbs. The dollar is fixed at two shillings and four pence.

Note.— The Department of Agriculture will be pleased to assist planters in finding a market for agricultural produce. Similar assistance is also offered by the Malayan Information Agency, 57, Trafalgar Square, London, W.C.2.

GENERAL RICE SUMMARY*

June, 1939.

Malaya.—Imports of foreign rice during June were 74,456 tons,† and exports 13,665 tons. Net imports were accordingly 60,791 tons, as compared with 54,712 tons in 1938.¶

Of the June imports, 51 per cent. were consigned to Singapore, 16 per cent. to Penang, 5 per cent. to Malacca, 21 per cent. to the Federated Malay States, and 7 per cent. to the Unfederated Malay States. The foreign imports by countries of origin were as follows (in tons, percentages in brackets):—Siam 48,965 (65.8), Burma 20,596 (27.6), French Indo-China 3,699 (5.0), other countries 1,196 (1.6).

Of the exports during June, 69 per cent. were consigned to the Netherlands Indies and 31 per cent. to other countries. The various kinds of rice exported were as follows (in tons, percentages in brackets):—Siam 11,027 (80.7), Burma 2,351 (17.2), French Indo-China 211 (1.5), parboiled 51 (0.4), Malayan production 25 (0.2).

June net imports by countries of origin were (in tons, percentages in brackets):- Siam 37,938 (62.4), Burma 18,245 (30.0), French Indo-China 3,488 (5.7), elsewhere 1,120 (1.9).

India.—Foreign exports during January to May were 130,000 tons, as compared with 119,000 tons in 1938, an increase of 9.2 per cent. Of these exports 3.8 (4.2) per cent. were to the United Kingdom, 2.3 (6.7) per cent. to the Continent of Europe, 30.8 (35.3) per cent. to Ceylon, 3.9 (5.1) per cent. to the Straits Settlements and the Far East, and 59.2 (48.7) per cent to other countries. The percentages in brackets are for the corresponding period of 1938.

Burma.—Foreign exports from the 1st January to 21st June totalled 2,285,102 tons, as compared with 1,928,423 in 1938, an increase of 18.5 per cent. Of these exports 56.7 (42.5) per cent. were to India, 7.0 (9.1) per cent. to the United Kingdom, 8.4 (8.0) per cent. to the Continent of Europe, 8.4 (10.5) per cent. to Ceylon, 9.0 (13.7) per cent. to the Straits Settlements and the Far East, and 10.5 (16.2) per cent. to other countries. The percentages in brackets are for the corresponding period of 1938.

Average June prices of rice in rupees per 100 baskets of 75 lbs. each at Rangoon were:—Big Mills Specials 224, Small Mills Specials 228.

Siam.—Exports of rice and rice products from Bangkok during January to April were 610,925 tons, as compared with 565,521 tons in 1938.

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* Abridged from the Rice Summary for June 1939 compiled by the Department of Statistics, Straits Settlements and Federated Malay States.

† Ton = long ton (2,240 lbs.)

¶ It is to be understood throughout the summary that all comparisons and percentage increases or decreases are in relation to the corresponding period of 1938.

Japan.—According to a report dated 29th June 1939, relating to the official estimate of the first Formosan rice crop, the area under rice shows a sharp decrease, the figures for the last three years being as follows:—

1937	...	...	729,239 acres
1938	...	...	713,491 ,,
1939	...	...	660,038 ,, (estimate).

Favourable weather at the time of planting was followed by an unduly cold winter, and an excessively wet and sunless spring, which encouraged insect pests. The rains were particularly heavy during the first three weeks of June, and a good deal of rice land in the southern prefectures was flooded. The combination of adverse weather and reduced acreage is expected to produce the smallest rice crop for many years.

The following is the estimated production for the first crop of 1939, actual figures for the same crop of the previous two years being shown for purposes of comparison:

		1939	1938	1937
		tons	tons	tons
"Horai" rice	...	358,761	409,836	390,636
Formosan rice (wet)	...	228,031	229,202	211,489
,, ,, (dry)	...	9,157	13,028	16,586
TOTAL	...	595,949	652,066	618,711

The above reduction in acreage has been in accordance with the rice policy which the Government General of Formosa has now followed for many years, of increasing the yield per acre, while reducing acreage, and giving the acreage saved to sugar and other special crops which cannot be grown in most other parts of the Japanese Empire.

But already four months ago the central authorities in Tokyo, taking alarm over a possible rice shortage, declared that the Formosan rice restriction policy was to be abandoned, and that production in the 1940 "rice year" (*i.e.* the second crop of 1939 and the first of 1940) was to be increased by 70,126 tons. It is singularly unfortunate for the Formosan authorities, whose policy was already in disfavour, that the first crop of 1939 should now show a decrease of nearly 56,518 tons; and one may surmise that the ill-luck of this exceptionally bad season coinciding with an exceptionally large reduction of acreage will make the central authorities still less inclined to listen to their pleas on behalf of sugar and other special crops.

It is evident that the new orders must at the best have produced considerable dislocation. The average yield per acre for the two crops has in recent years been about 1 ton, which will mean that about 40,000 additional acres will have to be put back to rice for each crop to meet the desired increase. Since much of the land is not two-crop land, the actual acreage required will probably in fact exceed this figure.

French Indo-China.—Entries of padi into Cholon during the first six months of 1939 totalled 1,107,312 tons, as compared with 697,014 tons in 1938, an increase of 58.9 per cent. Exports of rice during the same period were 1,034,820 tons, as compared with 694,620 tons in 1938, an increase of 49.0 per cent.

The price of rice in the Saigon market rose in May from $2.93 to $3.03 per picul, but fell to $2.91 at the close. Padi prices remained stable, rising from $1.90 to $1.97, and closing at $1.91.

The Netherlands Indies.—The latest information available was published in the March Summary.

Ceylon.—Imports during the first half of 1939 totalled 298,608 tons, as compared with 279,364 tons in 1938, an increase of 6.9 per cent. Of these imports 15.2 (17.3) per cent. were from British India, 62.8 (71.5) per cent. from Burma, 0.3 (0.3) per cent. from the Straits Settlements, and 21.7 (10.9) per cent. from other countries. The 1938 percentages are in brackets.

Europe and America.—Shipments from the East to Europe from the 1st January to 14th June totalled 855,088 tons, as compared with 734,449 tons in 1938, an increase of 16.4 per cent. Of these shipments 37.9 (46.5) per cent. were from Burma, 48.6 (43.1) per cent. from Saigon, 12.6 (8.6) per cent. from Siam, and 0.9 (1.8) per cent. from Bengal. The 1938 percentages are in brackets.

Shipments for the Levant from 1st January to 10th June totalled 13,228 tons, as compared with 22,305 tons in 1938, a decrease of 40.7 per cent. Shipments for Cuba, West Indies and America from 1st January to 5th June were 105,562 tons, as compared with 88,828 tons in 1938, an increase of 18.8 per cent.

MALAYAN AGRICULTURAL EXPORTS, MAY, 1939.

PRODUCT.	Net Exports in Tons				
	Year 1938	Jan./May 1938	Jan./May 1939	May 1938	May 1939
Arecanuts ...	33,769	17,743	15,881	3,766	1,499
Coconuts fresh†‡ ...	116,743†	36,414†	39,755†	6,231†	5,301†
Coconut oil‡ ...	49,140	17,585	23.370	3,069	5,850
Copra‡ ...	68,754	14,987	9,614	2,545	2,867
Copra cake ...	7,112	612	3,053	103	676
Gambier, all kinds ...	1,632	2,386	760	298	177
Palm kernels ...	9,359	3,592	4,387	807	1,018
Palm oil ...	54,377	20,599	18,438	4,084	2,458
Pineapples, canned ...	73,168	33,689	38,487	6,781	10,224
Rubber¶ ...	360,898¶	165,449¶	131,478¶	29,481¶	25,021¶
Sago,—flour ...	4,537	2,219	3,128	87	506
,, —pearl ...	4,203	1,699	1,547	324	364
,, —raw ...	5,088*	2,767*	1,940*	435*	448*
Tapioca,—flake ...	981	126*	454	446*	119
,, —flour ...	3,072*	1,368*	1,352*	106*	265*
,, —pearl ...	17,818	6,708	6,961	1,476	1,776
Derris (tuba root) ...	676	165	580	34	150
‡Copra equivalent ...	150,944	28,575	48,385	4,987	12,484

† hundreds in number. * net imports. ¶ production.

MALAYAN PRODUCTION OF PALM OIL AND KERNELS

(In long tons, as declared by Estates).

Month 1939	Palm Oil			Palm Kernels		
	F.M.S.	U.M.S.	Malaya	F.M.S.	U.M.S.	Malaya
January ...	2,402.5	2,726.3	5,128.8	429.7	502.0	931.7
February ...	2,193.4	1,693.3	3,886.7	372.9	282.0	654.9
March ...	2,453.1	2,324.8	4,777.9	437.9	394.0	831.9
April ...	2,160.5	2,082.2	4,242.7	423.4	346.0	769.4
May ...	2,066.0	1,760.1	3,826.1	403.1	274.1	677.2
June ...	2,204.8	2,030.2	4,235.0	368.9	318.0	686.9
Total ...	13,480.3	12,616.9	26,097.2	2,435.9	2,116.1	4,552.0
Total January to June, 1938 ...	11,870.6	8,993.9	20,864.5	2,145.2	1,560.0	3,705.2
Total for the year 1938 ...	28,979.0	22,087.7	51,066.7	5,158.9	3,620.0	8,778.9

Stocks on estates as at 30th June, 1939, were: palm oil 6,731 tons, palm kernels 528 tons.

ACREAGES OF TAPPABLE RUBBER ACTUALLY TAPPED AND NOT TAPPED ON ESTATES OF 100 ACRES AND OVER, FOR THE MONTH ENDING 30TH JUNE, 1939.

STATE OR TERRITORY	Estimated Acreages of Tappable Rubber (9)+(11)	ACREAGES OF TAPPABLE RUBBER NOT TAPPED				Area of tappable rubber never been tapped (b)		Total area not tapped (3)+(5) (c)		TOTAL AREA TAPPED DURING THE MONTH		Area of tappable rubber rested under rotational systems (c)	
		On estates which have entirely ceased tapping		On estates which have partly ceased tapping (a)									
		Acreage	Percentage of (3) to (2)	Acreage	Percentage of (5) to (2)	Acreage	Percentage of (7) to (2)	Acreage	Percentage of (9) to (2)	Average	Percentage of (11) to (2)	Acreage	Percentage of (13) to (2)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
S. S.—													
Province Wellesley ...	42,994	1,024	2.4	15,255	35.5	473	1.1	16,279	37.9	26,715	62.1	7,746	18.0
Malacca ..	119,397	5,609	4.7	37,407	31.3	2,176	1.8	43,016	36.0	76,381	64.0	24,289	20.3
Penang ..	2,505	nil	nil	1,250	49.9	35	1.4	1,250	49.9	1,255	50.1	60	2.4
Singapore ...	31,953	5,306	16.6	10,244	32.1	175	0.5	15,550	48.7	16,403	51.3	3,331	10.4
Total S.S. ...	196,849	11,939	6.1	64,156	32.6	2,859	1.5	76,095	38.7	120,754	61.3	35,426	18.0
F. M. S.—													
Perak ...	284,546	11,205	3.9	74,957	26.4	7,891	2.8	86,162	30.3	198,384	69.7	49,444	17.4
Selangor ...	317,006	11,898	3.8	74,200	23.4	7,175	2.3	86,098	27.2	230,908	72.8	52,967	16.7
Negri Sembilan ...	262,732	13,029	5.0	79,848	30.4	13,042	5.0	92,877	35.4	169,855	64.6	39,753	15.1
Pahang ...	85,718	4,935	5.8	27,767	32.4	5,724	6.7	32,702	38.2	53,016	61.8	10,061	11.7
Total F.M.S. ...	950,002	41,067	4.3	256,772	27.1	33,832	3.6	297,839	31.4	652,163	68.6	152,225	16.0
U. M. S.—													
Johore ...	480,199	25,554	5.3	142,056	29.6	38,244	8.0	167,610	34.9	312,589	65.1	67,511	14.1
Kedah ...	199,193	10,331	5.2	33,677	16.9	6,581	3.3	44,008	22.1	155,185	77.9	44,189	22.2
Kelantan ...	31,204	403	1.3	7,422	23.8	2,398	7.7	7,825	25.1	23,379	74.9	5,569	17.8
Trengganu (d) ...	4,817	nil	nil	42	0.9	nil	nil	42	0.9	4,775	99.1	2,135	44.3
Perlis (e) ...	1,459	380	26.0	341	23.4	155	10.6	721	49.4	738	50.6	394	27.0
Brunei ...	5,913	nil	nil	2,218	37.5	316	5.3	2,218	37.5	3,695	62.5	1,216	20.6
Total U.M.S. ...	722,785	36,668	5.1	185,756	25.7	47,694	6.6	222,424	30.8	500,361	69.2	121,014	16.7
Total MALAYA ...	1,869,636	89,674	4.8	506,684	27.1	84,385	4.5	596,358	31.9	1,273,278	68.1	308,665	16.5

Notes.—(*a*) Area out-of-tapping on estates which have partly ceased tapping refers to areas definitely being rested and excludes areas on any tapping round.

(*b*) The acreage shown in column (7) is included in columns (3) and (5).

(*c*) Areas of tappable rubber rested under rotational systems are not considered as out-of-tapping and therefore columns (11) and (12) include columns (13) and (14) respectively.

(*d*) Registered companies only.

(*e*) Figures for the quarter ending 30th June, 1939.

MALAYAN RUBBER STATISTICS Table I.

ACREAGE, STOCKS, PRODUCTION, IMPORTS AND EXPORTS OF RUBBER, INCLUDING LATEX, CONCENTRATED LATEX AND REVERTEX.
FOR THE MONTH OF JUNE, 1939, IN DRY TONS.

State or Territory	Stocks at beginning of month 1			Production by Estates of 100 acres and over		Production by Estates of less than 100 acres estimated 2		Imports				Exports including re-exports				Stocks at end of month			Consumption 3	
								during the month		January to June 1939		during the month		January to June 1939						
	Ports	Dealers	Estates of 100 acres and over	during the month	Jan. to June 1939	during the month	Jan. to June 1939	Foreign	From Malay States & Labuan	Foreign	From Malay States & Labuan	Foreign	Local	Foreign	Local	Ports	Dealers	Estates of 100 acres and over	during the month	Jan. to June 1939
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
MALAY STATES :—																				
Federated Malay States ...	...	4,200	25,187	9,757	56,302	1,219	20,604	Nil	Nil	Nil	Nil	9,062	359	64,643	12,873	...	3,722	27,200	20	99
Johore ...	...	1,651	9,643	4,261	25,197	1,119	14,041	Nil	68	Nil	270	2,017	2,763	14,821	24,908	...	1,482	10,480	...	...
Kedah ...	...	169	5,408	2,491	13,872	206	3,629	Nil	Nil	Nil	Nil	1,247	1,164	8,232	9,440	...	110	5,753	...	...
Perlis ...	...	12	24	14	49	6	105	Nil	Nil	Nil	Nil	Nil	23	Nil	164	...	3	30	...	...
Kelantan ...	...	*465	500	345	1,773	448	2,813	Nil	Nil	Nil	Nil	147	395	1,600	2,858	...	435	781	...	...
Trengganu ...	...	18	337	134	766	58	1,107	Nil	Nil	Nil	Nil	Nil	127	Nil	1,793	...	Nil	420	...	...
Brunei ...	...	8	73	42	206	35	317	...	...	...	...	...	78	...	543	...	Nil	80	...	...
Total Malay States	...	6,523	41,172	17,044	98,165	3,091	42,616	Nil	68	Nil	270	12,473	4,909	89,296	52,579	...	5,752	44,744	20	99
S. SETTLEMENTS :—																				
Malacca ...	...	1,233	2,245	927	5,413	353	2,668	Nil		Nil		1,643		12,173		...	1,124	2,444	...	...
Province Wellesley ...	...	516	853	394	2,026	137	839	Nil		Nil		3,778		31,891		...	503	994	...	...
Penang ...	1,366	2,302	13	16	90	70	358	1,577	6,690	13,704	54,252		Nil		Nil	800	2,516	12	...	...
Singapore ...	4,936	12,270	263	113	602	59	262	7,955		69,233		13,647		113,728		4,740	11,529	249	25	160
Labuan ...	...	19	Nil	Nil	Nil	4	50	35		296		Nil		Nil		...	12	Nil	...	...
Total Straits Settlements ...	6,302	16,340	3,374	1,450	8,131	623	4,177	9,567	6,690	83,233	54,252	19,068	Nil	157,792	Nil	5,540	15,684	3,699	25	160
Total Malaya ...	6,302	22,863	44,546	18,494	106,296	3,714	46,793	9,567	6,758	83,233	54,522	31,541	4,909	247,088	52,579	5,540	21,436	48,443	45	259

*Figures amended.

TABLE II
DEALERS' STOCKS, IN DRY TONS 3

Class of Rubber	Federated Malay States	S'pore	Penang	Province We'sly D'dings M'cca.	Johore	Kedah
22	23	24	25	26	27	28
DRY RUBBER	3,249	11,312	2,432	1,392	1,255	65
WET RUBBER	473	217	84	247	227	45
TOTAL ...	3,722	11,529	2,516	1,639	1,482	110

TABLE III
FOREIGN EXPORTS

PORTS	For month	Jan. to June 1939
29	30	31
Singapore ...	21,597	171,548
Penang ...	6,328	51,181
Port Swettenham.	3,496	23,729
Malacca ...	120	630
MALAYA ...	31,541	247,088

TABLE IV
DOMESTIC EXPORTS 4

AREA	For month	Jan. to June 1939
32	33	34
Malay States ...	17,282	141,541
Straits Settlements	1,656	11,895
MALAYA ...	18,938	153,436

Notes:—
1. Stocks on estates of less than 100 acres and stocks in transit on rail, road or local steamer are not ascertained
2. The production of estates of less than 100 acres is estimated from the formula: Production + Imports + Stocks at beginning of month = Exports + Stocks at end of month, + Consumption, *i.e.*, Column [7] = Columns [13] + [14] + [17] + [18] + [19] + [20] − [2] − [3] − [4] − [5] − [9] − [10]. For the Straits Settlements the production of estates of less than 100 acres is represented by sales or exports as shown by cess paid.
3. Dealers' stocks in the Federated Malay States are reduced to dry weights by the following fixed ratios: unsmoked sheet, 15% wet sheet, 25% scrap, lump, etc., 40%; stocks elsewhere are in dry weights as reported by the dealers themselves.
4. Columns (33) and (34) represent exports of rubber subject to regulation which, for Singapore and Penang Islands are represented by sales or exports as shown by cess paid.
5. All statements are brought up to date monthly, and any inaccuracies that may be disclosed are corrected in the totals; the latest publication therefore, is always the most reliable.
6. The above, with certain omissions, is the Report published by the Registrar-General of Statistics, S.S. and F.M.S., at Singapore on 27th July, 1939.

Locality.	Air Temperature in degrees Fahrenheit							Earth Temperature		Rainfall								Bright Sunshine.		
	Means of			Absolute Extremes						Total.		Most in a day.	Number of days.					Total.	Daily Mean.	Per cent.
	A. Max.	B. Min.	Mean of A and B	Highest Max.	Lowest Min.	Lowest Max.	Highest Min.	At 1 foot	At 4 feet			Amt.	Precipitation .01 in or more	Precipitation, .04 in or more	Thunder-storm	Fog morning obs.	Gale force 8 or more			
	°F	°F	°F	°F	°F	°F	°F	°F	°F	in.	mm.	in.						hrs.	hrs.	
Railway Hill, Kuala Lumpur, Selangor ...	90.3	72.4	81.3	94	69	81	75	84.3	85.2	5.05	128.3	1.07	16	16	7	1	1	188.05	6.27	51
Bukit Jeram, Selangor ...	88.9	73.0	80.9	92	71	79	76	85.3	87.4	5.81	147.6	2.17	8	6	—	1	1	219.20	7.31	59
Sitiawan, Perak ...	89.8	73.1	81.5	93	70	80	75	84.6	85.1	4.12	104.6	1.23	11	9	1	—	—	198.70	6.62	54
Ipoh Aerodrome, Perak ...	90.7	72.4	81.5	94	69	80	75	84.1	84.9	4.74	120.4	1.79	14	11	3	—	—	190.75	6.36	51
Temerloh, Pahang ...	89.4	72.7	81.1	95	70	81	76	85.3	86.7	12.16	308.9	2.20	16	13	6	7	1	162.35	5.41	44
Kuala Lipis, Pahang ...	88.6	71.7	80.1	92	69	79	75	84.1	85.0	10.23	259.8	1.82	18	17	9	27	1	158.20	5.27	43
Kuala Pahang, Pahang ...	86.5	73.9	80.2	91	71	78	77	85.3	86.8	5.32	135.1	1.41	15	14	—	—	2	193.85	6.46	53
Kallang Aerodrome, S'pore ...	85.8	76.3	81.1	89	72	78	82	83.1	84.3	5.67	144.0	2.19	15	13	4	—	1	173.75	5.79	47
Bayan Lepas Aerodrome Penang ...	87.3	74.2	80.7	90	72	78	77	84.7	85.3	9.72	246.9	2.73	19	17	—	—	—	183.30	6.11	49
Malacca Town, Malacca ...	85.7	74.1	79.9	90	70	80	77	84.5	85.4	6.88	174.8	2.14	13	10	7	—	3	204.10	6.80	55
Kluang, Johore ...	88.2	71.3	79.7	94	69	79	73	82.1	83.0	9.10	231.1	3.35	15	12	6	13	—	166.35	5.55	45
Mersing, Johore ...	87.0	71.9	79.5	90	70	79	75	82.9	83.1	2.83	71.9	0.84	13	11	3	—	—	201.60	6.72	55
Alor Star, Kedah ...	87.5	74.6	81.1	90	72	79	77	85.1	85.8	10.96	278.4	6.32	17	13	—	—	1	190.75	6.36	51
Kota Bahru, Kelantan ...	89.4	73.9	81.7	92	71	79	78	85.7	85.6	10.40	264.2	1.92	16	14	1	—	—	221.05	7.37	59
Kuala Trengganu, Trengganu	88.0	73.2	80.6	90	70	77	76	83.7	85.3	4.53	115.1	0.94	12	9	5	1	1	210.75	7.03	57
Labuan ...	87.3	76.9	82.1	90	73	84	80	85.2	86.8	13.88	352.6	4.31	13	11	1	—	—	238.25	7.94	64
HILL STATIONS.																				
Fraser's Hill, Pahang 4268 ft.	74.8	63.0	68.9	78	59	67	65	72.1	72.2	3.47	88.1	1.69	15	11	1	7	—	159.35	5.31	43
Cameron Highlands, Tanah Rata, Pahang 4750 ft. ...	72.9	56.9	64.9	77	51	68	63	70.1	69.7	7.73	196.3	2.22	21	18	3	2	—	154.95	5.17	42
Cameron Highlands, Rhododendron Hill, Pahang 5120 ft. ...	73.1	59.6	66.3	78	57	68	63	*	*	7.90	200.7	2.48	20	18		—	3	163.25	5.44	44

* Not recorded.

Compiled from Returns supplied by the Meteorological Branch, Malaya.